THE MILITARY SURGEON

MEDICINE

JOURNAL OF
THE ASSOCIATION OF MILITARY SURGEONS
OF THE UNITED STATES

EDITED BY
JAMES ROBB CHURCH

VOLUME LII

WASHINGTON, D. C.
THE ASSOCIATION OF MILITARY SURGEONS
OF THE UNITED STATES
1923

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THE

MILITARY SURGEON

VOL. LII JANUARY, 1923 NUMBER 1

SAFETY IN AVIATION[1]

BY BRIGADIER GENERAL W. H. WILMER
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AFTER more than two thousand years of attempted flight, in which many lives have been lost and hearts broken by failure, aviation is an accomplished fact.

Alphonse Berget in 1911 wrote: "If aerial navigation counts its victors—alas! it numbers also its victims. . . . The conquest of the air, like all other conquests, has its battlefields strewn with the remains of its heroes. In its two forms it has already a long martyrology."

It is very certain that no one factor serves more to retard the progress of flying than the conviction of the public mind that aviation is too dangerous to be either practicable or profitable. Hence, the future of flying really depends upon such scientific working out of the important problems of pilot and plane that safety in the air will be ensured.

It is the experience of all students of aviation accidents that the human element is a most important factor. This is apparent from the following bulletin made public in 1919:

TEXT SUMMARY, AIR SERVICE

Only 4 *per cent of flying fatalities due to failure of machine.*

"Since January 1, 1919, the Air Service has had 300 fatalities at flying fields in the United States. Of these 14, or 4 per cent, were attributed to failure of engine, or collapse of plane; the cause of 9 per cent of all fatalities is unknown.

	Number of fatalities	*Per cent of total*
Tail spin	118	30
Collision	61	16
Nose dive	47	12
Unknown	36	9
Side slip	21	5
Stall	19	5
Fire	15	4
Failure of machine	14	4
Struck by propeller	13	3
Others	46	12
Total	390	100

[1] From the President's address at the Fourth Annual Meeting of The Air Service Medical Association, St. Louis, Mo., Tuesday, May 23, 1922.

Thus 96 per cent of these fatalities were due to faults, or circumstances directly connected with the pilot himself.

The correction of these faults must be preventive in character. High standards, mental, nervous, physical, should be maintained in selecting men for aviation; and the pilots thus chosen should be kept fit to stand the physical and mental strain of flying.

The problems that concern the flyer himself—his training, his physical fitness, his psychology—lie very naturally within the special sphere of the student of medical aviation. But for the better solution of those problems, the study of the human machine should be supplemented by some practical knowledge of the laws of aerodynamics, and of the construction of the various types of aeroplanes and their motors. The "dope" used upon the wings will come under the student's consideration because of its effect upon the workers in the shop; even the position of the end of the exhaust is important, for its faulty location may expose the flyer to the poisonous fumes of carbon monoxid. Again, the large blind angles resulting from the fuselage and the wings of the plane have been the cause, in the writer's personal observation, of the loss of many valuable lives.

If it be true that the "present is the past entered through another gate," it may not be unprofitable to glance for a moment over the outlines of the story of aviation.

Chanute, who by the time of his death in 1910 had become a foremost authority upon aviation, wrote in 1892: "There probably have been in all ages of the world men whose imaginations were fired by the sight of the soaring birds, and some who tried to imitate them."

The earliest legendary account of flying is accompanied by a description of the disastrous results. According to this mythical story, Daedalus was so anxious to escape from the Isle of Crete that he built wings for his son Icarus and for himself. He succeeded in landing in Italy, but Icarus fell into the sea.

A later legend—of about 750 B.C.—tells of Bladud, the father of King Lear, who soared above the city of Trinovante. Unhappily, he lost his balance and was killed by falling upon a temple.

A later, and more authentic story, is the one of Simon the Magician (about 67 A.D.) who also was killed in flight. The supposed cause of his accident was the withdrawal of the supporting Demons at the prayer of St. Peter. Chanute (quoting M. de Graffigny) says of this legend: "It seems, therefore, certain from this tale, which has come down to us without any material alteration, that even in that barbarous age a man succeeded in rising into the air from the earth by some means which have unfortunately remained unknown."

In 1500 Leonardi di Vinci invented wings which were moved downward by the legs and upward by the arms. Fortunately, he did not attempt to put his invention to the test, and the great artist-inventor was spared to the world.

The first authentic wing experiment on which an actual flight was attempted, was that of a French tightrope dancer named Allard, about the year 1660. In the presence of his sovereign, Louis XIV, he attempted to fly, or glide, from the terrace of St. Germain to the woods of Vesinet. But his strength was insufficient for the task. He fell at the foot of the terrace and was "grievously hurt."

In 1742, the Marquis de Bacqueville fared very little better in his attempted flight across the Seine from Rue des Saints Péres to the Tuilleries, a distance from 500 to 600 feet. He fell on a barge in the river, breaking his leg. He never attempted to fly again.

Even the church fathers were not immune from the fever of flying. The Abbé Desforges invented a flying chariot. The narrative very naïvely says he was saved because his apparatus would neither fly nor glide, and the good father suffered a harmless tumble.

In 1812, J. Degen, a clockmaker of Vienna, used umbrella-like wings and a small supporting balloon. The wind prevented the success of his undertaking, and the spectators, considering him an imposter, gave him an unmerciful beating.

In 1854, Letur used a device that was somewhat similar, but with a steering tail in addition. After casting off from his supporting balloon, he came in contact with some trees as he was landing. He later died from his injuries.

In 1874, De Graef, a Belgian shoemaker, used a device of beating wings and a parachute. On his first real descent, after cutting loose from his supporting balloon, the wings collapsed. "He came down like a stone, and was killed on the spot."

It was not until 1784 that serious consideration was given to any other power than man's muscular exertion. Among the first to seriously make such a proposal was Gerard.

Fortunately for life and limb, the period following the invention of the steam engine was rather harmlessly employed in inventing aerial toys in which steam, coiled springs and twisted rubber bands were used as the motive power.

The discovery of gasoline and the invention of the motor gave rise to the first practical power for aerial navigation, presenting the requisites of maximum power with minimum weight.

The first real flight in the history of aviation in which the flyers landed in safety was made by the Wrights on December 17, 1903. The

distance was 852 feet. It is astonishing that the 105 flights in 1904 and 49 flights in 1905 were so free from accidents. However, one well remembers when Orville Wright's propeller broke on September 17, 1908. He was seriously injured and Lieutenant Selfridge was killed.

During the early history of aviation, accidents were the result of the absolute ignorance of the laws of aerodynamics. Those inventors were saved who did not attempt to actually use their inventions, or who could not rise sufficiently above the earth's surface to experience a serious fall. Chanute scores the "egregious folly" of those—and other —experimenters, who needlessly lost their lives by attempting impossible flights. He says: "A few prior experiments, with a bag of sand, instead of the man, would have exhibited the action that was expected"— a wise precautionary suggestion linking the history of the past with the functions of the present-day "flight surgeon."

While it is certain that from legendary times men have sought to emulate the flight of birds, it seems equally sure that birds have not been known to execute any of the maneuvers so familiar to the modern aviator. For nothing in the flight of birds suggests a side slip, barrel roll, loop or tail spin; and there seems to be no record of any attempt on the part of the birds to suddenly ascend from low levels to the height attained by those flyers who fought at an altitude of more than 15,000 feet.

The modern aviator has really outdone the birds in their own element at every point except in the matter of safety. This great achievement has been admirably summed up in the following words by an English confrere:

A man is called upon in a few weeks to break century-old bonds and to rise from ground level to great altitudes; from comparative warmth often to intense cold; from relative quiet to a continuous rush and roar; from a state of equilibrium to one of instability; from muscular and mental rest to highly skilled and nerve trying evolutions; from safety to possible death. All this in the space of a few minutes, and the return, at least as suddenly. It is no exaggeration to say that such a man has taken a greater bound forward than did his ancestors in several hundred years.

But the wonder of the achievement does not lessen the tragedy of the daily accounts in the public press of the toll paid in human life for the conquest of the air.

Of all the accidents in present-day flying, there is one that carries terror to the stoutest heart—fire. The DH-4 of our day in France was always spoken of as the "flaming coffin." No one who has seen a man burned in flight, or after a crash, will ever be able to efface the horror of it from the memory.

Fortunately, the Engineering Division of the Air Service, in order to prevent fires, is working out most important improvements, "such as crash-proof tanks, mechanically operated fuel pumps, fuel system refinements, fire extinguishing distribution system, etc." During the year 1921, the Air Service experienced no fires occurring in the air, but there were twenty-seven on the ground; in the commercial field, there were four in the air and four on the ground. All other elements of safety have been studied by the builders of the planes. How well they have "succeeded is very strikingly shown from the fact that aircraft casualties due to structural defects of the craft since the beginning of flying in the United States are probably less than one-half of one per cent."

Some of the later improvements which tend directly to increase the safety of the plane, are greater strength and higher lifting qualities in the wing sections; greater and easier control; greater stability; propeller designs that will take advantage of every condition of flight; improvement in wheels, tires, landing skids, etc., which assist the operator in alighting and taking off safely; and the greater use of metal in the structural parts of machines. The new oil and fuel supply system is efficient and reliable yet not dangerous in case of accident. The improved carbureter is practically "foolproof," and the magneto is one that insures the proper ignition under all conditions. The new propellers are made of "Bakerite," a great advance over the old ones of wood. The changes in the Liberty motor have eliminated all the rubber parts that come in contact with the gasoline. The air intake is now on the outside. In addition to other alterations in the DH-4 to increase safety and stability, the relative positions of pilot and gas tank have been changed.

It is said that probably more than half of the instruments used on an airplane are placed there for the purpose of increasing the safety of the operator. Some of these are the aerial compass, drift indicator, inclinometer, sextant, altimeter, and the air speed indicator. An oxygen supply system is provided and so are parachutes. The question of proper clothing is being seriously studied.

But one of the most far-reaching inventions for safety is radio communication. "By means of the radio direction finder in fog, mist, cloudbank and night, the operator of an airplane or airship is guided on his course, and to a suitable landing place."

While stationed at the great Aviation Instruction Center at Issoudun, France, on twenty-five occasions, the writer presided as a member of the board appointed to investigate the death of a flyer or mechanic.

All details in regard to the plane, the pilot and the cause of the

accident were carefully considered. During the month of October, 1918, out of ten fatal accidents, where the cause could be definitely assigned, eight were avoidable. To quote from Lieut. Colonel Rowntree's report: "They include one man with poor vision who collided with an experienced pilot, resulting in two deaths; one man flying while obviously ill; two men flying while recovering from the 'flu' . . .; one man taking off too close to a hangar; two men breaking rules and regulations of combat; . . . one man carefully avoiding hangars and wires at the proximal end of the small field and crashing at the distal end; one man falling into the death trap of the fatal turn with a dead engine." This last type of accident was so needless yet so frequent; and even trained pilots, apparently in accordance with the "homing instinct," *would* attempt to turn back to the field when the motor stalled instead of planing down to safety. It is only by constant instruction, training and practice that the proper reaction through the higher brain centers can be made to supersede the fatal instinct to turn under these critical conditions.

It is vitally important that the standards for selecting the flyer be high, both for the Air Service and for commercial aviation. The invitation to death extended by the "waiver" should be eliminated. The flyer should be kept fit and thoroughly taught the folly of flying when not fit.

A flying blouse with soft collar would add much to the comfort and, it is felt, the safety of the pilot. For there have been many complaints against the present army blouse in flying, and this discomfort the writer has personally experienced in the air. Pilots often said during the war: "In twisting my head about in the search for other planes, I have nearly sawed my neck off on the stiff collar."

The flyer should be thoroughly initiated into the art of "air sight," which is developed by the constant movement of the head and eyes to overcome the obstructions offered to vision by the wings and fuselage. Certain it is that accidents continue to occur because one pilot does not see the other plane.

The School of "Flight Surgeons" at Mitchel Field, Long Island, is doing most valuable work in instructing the medical men in the Air Service in this country.

It is most encouraging to know that the realization of the great necessity of carefully selecting the flyer is spreading. A short while ago a letter was received from an old pupil, Dr. J. M. Penichet of Havana, saying that he had been appointed to lecture on medical aviation to the surgeons in the Air Service of the Cuban Army.

Everyone who witnessed the inspiring stunts at Issoudun will recall

the wonderful flying of Captain Joyce. In a letter recently received from him, he speaks of having just met, in Mexico, Major Edwards, who was stationed during the war at Columbey-les-belles. Major Edwards is now examining candidates for aviation in the Mexican Army.

To all of us who have felt the lure of flying, it is cheering to see in the papers the daily Flying Weather Forecast, for it indicates the growing practicability of flying and the effort to add another element to its safety.

FLYING WEATHER FORECAST

Forecast of flying weather for May 17, 1922:

Washington to Long Island, N. Y.—Showers Thursday; moderate to fresh east and southeast winds up to 1,000 feet, and fresh south and southwest winds at 5,000 feet.

Washington to Norfolk, Va.—Mostly cloudy and probably showers Thursday; moderate to fresh east to south winds up to 1,000 feet, and fresh south and southwest winds at 5,000 feet.

Washington to Dayton, Ohio.—Showers and possibly thunderstorms Thursday; moderate east and southeast winds up to 1,000 feet, and fresh south and southwest winds at 5,000 feet.

In a special cable to the *New York Herald* on May 20, 1922, it was reported that there were twenty-six air lines from London; and that to and from Paris alone there were nine daily services, the trip taking two hours. The airplane companies claim "a greater factor of safety in air travel than by other means, and back up the claim by statistics that cannot be challenged." The fare is no greater than by "first class" travel by other routes.

During 1921, French commercial airplanes carried over 10,000 passengers and more than 175,000 tons of baggage and mail. During that period, there were forty accidents with eleven persons killed and six injured. The schedules are being carried out with an efficiency of 97 per cent, in spite of the increased activity.

Notwithstanding the marvelous achievements in flying, there are still many who question whether aviation, apart from its military value, will present in the future any practical, commercial results that will justify the immense amount of work that is necessary to perfect the plane and fit the operator for his calling. Some of these questions were answered by Chanute nearly thirty years ago when he wrote: "We may be sure that such an untrammeled mode of transit will develop a usefulness of its own, differing from, and supplementing, the existing modes of transportation." Our cooperation in developing the element of safety in aviation may hasten the realization of the hope expressed by this

envisioned engineer: "That it shall abridge distance, make all parts of the globe accessible, bring men into closer relations with each other, advance civilization and hasten the promised era in which there shall be nothing but peace and good-will among all men."

The Henry S. Wellcome Prizes

Competition open to all medical officers and former medical officers of the Army, Navy, Public Health Service, Organized Militia, U. S. Volunteers, and of the Reserves of the United States:

PRIZE FIRST: A GOLD MEDAL AND $300

PRIZE SECOND: A SILVER MEDAL AND $200

Competition for 1923 will be based on essays on prescribed subjects, as follows:

First Prize.—"Benefits Derived by Military Medical Science from Animal experimentation."

Second Prize.—"The Training of the Medical Student for Service in Time of War."

Each competitor must furnish five copies of his competitive essay. Essays must not be signed with the true name of the writer, but are to be identified by a *nom de plume* or distinctive device. They must be forwarded to the Secretary of the Association of Military Surgeons of the United States, Army Medical Museum, Washington, D. C., so as to arrive at a date not later than **September 15, 1923,** and be accompanied by a sealed envelope marked on the outside with the fictitious name or device assumed by the writer and enclosing his true name, title and address. Essays must contain not less than 5,000 nor more than 20,000 words, exclusive of tables. The envelopes accompanying the winning essays will be opened at the annual, or other meeting, by the president, and the names of the successful contestants announced by him. The winning essays become the property of the Association and will be published in THE MILITARY SURGEON. The writers of the essays receiving "first honorable mention" will be awarded life membership in The Association of Military Surgeons, U. S.

PROGRESS IN AVIATION MEDICINE DURING 1921[1]

By Major L. H. BAUER
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PROGRESS in aviation medicine during the past year has been made entirely by the personnel of the Medical Research Laboratory and School for Flight Surgeons and those formerly connected with it. In a brief paper it will be possible to give only a short summary of the most recent articles and recent research, and those interested for further details are referred to the original articles.

In aviation physiology there have appeared three articles the past year. One of these is entitled "A Study of the Influence of Various Circulatory Conditions on the Reaction to the Low Oxygen of Rebreathing," by Edward C. Schneider and Dorothy Truesdell (*American Journal of Physiology*, June, 1921, Vol. 56, pp. 241–248). The same material with the addition of a larger amount of statistical data was discussed under the same title in Air Medical Service Information Circular, July 15, 1921, Vol. 3, pp. 122–133.

In this research ten special groups were selected from 2,000 cases for a study of the influence of various circulatory factors on the power of compensating to low oxygen under the conditions of our altitude classification rebreathing tests. The groups included high and low systolic pressures, high and low diastolic pressures, large and small pulse pressures, rapid and slow pulse rates and cases of systolic pressure rise and fall on standing. A total of 554 cases were carefully examined and the mean or average reactions of each group determined. While each group was found to make the compensations to low oxygen in a similar manner and to tolerate equally low percentages of oxygen, yet the plotted curves of the individual groups presented somewhat different pictures. The principal conclusion drawn was that none of the conditions studied appeared to place the heart and the nervous system under a handicap that is not present in average conditions of heart frequency and arterial blood pressures. It was shown that the rise in systolic pressure, at least under the conditions studied, is not great enough to place the heart under a dangerous strain.

The next paper published was "Physiological Effects of Altitude" by Edward C. Schneider (Physiological Reviews, October, 1921, Vol. 1, pp. 631–659). This paper sums up the present day opinions on the subject of the influence of high altitudes and low oxygen on mankind. In it are reviewed all of the experimental contributions of the last

[1] Read at the Fourth Annual Meeting of the Air Service Medical Association of the United States, St. Louis, Mo., May 23, 1922.

fifteen years. The bibliography, which embraces almost exclusively recent publications, includes 127 separate articles and books. It is the most complete paper yet written on the subject. After an explanation of anoxemia, the chief physiological factor of altitude, its effect on the aviator who experiences it for a short time, and on the mountaineer who through residence acclimates himself, Dr. Schneider discusses the respiratory response to altitude and the lowering of the CO_2 tension in the alveoli. He discusses the theory of O_2 secretion in the lungs and rejects it. He gives a careful explanation of the blood changes in acclimatization, the increase in hemoglobin, the effect of altitude on the H-ion concentration of the blood and the mechanism by which this balance is maintained. He discusses the changes in the circulatory mechanism and the effect of physical exertion at high altitude and concludes as follows:

Accepting, then, for the present, only such factors as have been clearly demonstrated to serve in the compensation to anoxemia, we may rank them as follows: (1) Increased respiration; (2) chemical alterations in the blood; (3) increased hemoglobin. The respiratory change ranks first because by this means the partial pressure of the oxygen in the lungs is raised above what it would normally be at the altitude. This favors not only the absorption of oxygen in the lungs but also, after acclimatization, the passage of oxygen from the blood to the tissues. Since the alkalosis resulting from augmented breathing interferes with the passage of oxygen from the blood to the tissues, it cannot be questioned but that the restoration of the normal H-ion content, by the elimination of the excess of alkali, constitutes a compensatory process of almost if not equal importance with the increase in breathing. The advantage gained by the increase in hemoglobin is not so obvious. Barcroft finds the increase of but little value since, even if it be sufficient to restore to normal the actual quantity of oxygen in 1 c.c. of blood, then, because of the decrease in oxygen pressure, the rate of dissociation will be so slow that it will not allow the oxygen to pass to the tissues in anywhere near the same proportions. Haldane considers the advantage of the increase in hemoglobin due to the fact that the partial pressure of oxygen in the blood of the systemic capillaries is prevented from falling as low as it otherwise would.

The third paper presents the physiological aspects of the work of the Medical Research Laboratory. Under the caption, "The Human Machine in Aviation," the *Yale Review*[2] will publish in non-technical language descriptions of the physiological requisites of the successful pilot, of the compensations the body is called upon to make during flying, and lastly of the apparatus and tests used in the laboratory. The second contribution that is soon to appear is a chapter on "Climatol-

[2] The Yale Review, March, 1922 (Schneider).

ogy." This will be in an important book edited by Dr. Barker of the Johns Hopkins Medical School.[3]

The fire which destroyed the old laboratory and its equipment not only interrupted the investigations of the Department of Aviation Physiology but also destroyed the original data of parts of researches that were in progress at that time. Fortunately, considerable portions of original data and many summaries of results were in two desks that were only partly burned. Because of this a statistical study begun more than a year ago has been carried to completion and the results are in manuscript form almost ready for publication.

The investigation deals with the pulse rate and the three arterial pressures—systolic, diastolic and pulse pressure—under four conditions, viz., recumbency, standing, immediately after a standard exercise, and two minutes after exercise. The major part deals with observations on 2,000 men, but a second group of 200 more unselected cases, who were examined even more carefully, has been used to check the results obtained from the large group. In addition, a study was made of two small groups (144 and 204 cases) of men, judged by clinicians at the time of examination to be physically fit. The data are discussed from the standpoint of the distribution of cases, the amount of postural and exercise change, time required to return to normal after exercise, and the interdependence of the several factors. To determine the extent that one circulatory factor may be dependent upon others, two methods of study were used. In the first, the coefficients of correlation and other statistical relationships were calculated, and in the second a selection of groups of cases showing extreme and opposite conditions with respect to one factor have been examined as to the mean condition and reaction of all the other circulatory factors. Interesting tendencies and relationships have been established that add a new viewpoint to our knowledge of commonly observed circulatory factors. The summary of results is too long to incorporate in this report. One advantage gained from this investigation is the opportunity it offers to check the values used in the rating tables employed in the determination of physical fitness and staleness.

Several researches are now nearing completion: (1) Anoxic effects of rebreathing and the low pressure chamber have been studied on several circulatory factors and conditions not regularly considered in the altitude classification examination. In one series of runs venous pressure was taken by the Hooker method every minute. In another series capillary blood pressure was taken by means of the Danzer-Hooker

[3] Climatology—E. C. Schneider in "Endocrines and Metabolism." Ed. by Barker and Mosenthal—1922.

microtonometer, readings being taken as often as possible throughout the runs, averaging about every three minutes. The subjects for this series were selected with great care, only those whose capillaries showed a clear and unclouded reading being chosen. The rate of blood flow through the hands was also determined by the use of a Stuart calorimeter, readings being taken every minute before, during and for several minutes after each run. The hand volume was determined by the use of a hand plethysmograph. A rough estimate of the relative output of the heart was determined as evidenced by a recoil board curve or by the gaseous content of the blood and the lungs. After the completion of several more low pressure chamber experiments these data will be prepared for publication.

2. The influence of a gradual increase in the carbon dioxide of respired air has been studied with respect to the pulse rate, the arterial blood pressures, venous blood pressure, capillary blood pressure, hand volume, blood flow through the hand, the alveolar air composition, and the rate, depth and per minute volume of breathing. These data are ready to be written up for publication.

3. The cardiovascular rating scheme for physical fatigue and efficiency that has been in use in the Air Service for several years has been under special consideration. Attention was given to influence of the diurnal circulatory changes, observations having been taken on a group of subjects hourly for a period of twenty-four hours; to the influence of eating, of drinking, of smoking, of exercise, and of various mild pathological conditions.

4. A series of observations on the effect of passive change of posture on pulse rate and the arterial pressures was made by use of the orientator, observations being taken to show the effect of the horizontal and the inverted positions as well as the reactions after a series of about ten loops. This study was begun in 1920 and carried over into 1921. The work is not yet complete.

5. A series of experiments showing the effect of the inhalations of pure nitrogen, including observations on pulse rate, arterial pressures, hand volume with the use of the hand plethysmograph, and blood flow by the Hewlett method as well as rate and volume of respiration. This method brought about a rapid and acute oxygen want effect, the runs averaging in length from 40 to 80 seconds.

6. Experiments with dermographic tracings were continued both in routine examinations on subjects for the 609 examination and in experimental work to try the effects of different localities of the body, different temperatures, humidities, varying amounts of pressure and the effects of wind. The work has not yet reached the stage where definite conclu-

sions may be drawn, but it can safely be said that the conclusions drawn by former observers are unwarranted as they have not given due weight to the various factors affecting dermographia.

Other problems are now partially under way. (1) The influence of excessive breathing, resulting in a washing of carbon dioxide from the body, is being compared with the effects of low oxygen and of carbon dioxide. The first part of study will be confined to the circulation and respiration. This will be followed by (2) A study of the chemical urinary and blood changes resulting during (*a*) over ventilation of the lungs, (*b*) exposure to a gradually increasing amount of carbon dioxide, and (*c*) during the low oxygen effects of rebreathing.

Work has also begun on a study of metabolism during exposure to low barometric pressure in the low-pressure chamber. For this purpose, a series of Douglas bags is being used to collect the expired air for intervals of ten minutes. By this method it may be possible to determine why the breathing increases not only during an ascent but for a while after an altitude has been reached; and then later, even though the altitude is maintained, decreases slightly. Later, the influence of diet upon metabolism at high altitudes will be added to this study. The effects of physical work will also be considered. For this purpose a bicycle ergometer will be used so that the amount of work can be exactly determined.

In neuro-psychiatry the work at the laboratory has been along the following lines:

1. Neuro-psychiatric examinations and personality studies.

2. A digest of the literature on neuro-psychiatry and a preparation of a series of papers on neuro-psychiatry to serve as a textbook in the School for Flight Surgeons.

3. A digest of the literature and analysis of the records and work of the laboratory on the subject of Personality Study. A paper has been prepared on this subject by Major Longacre and will be published shortly.

4. Clinical work.

In the routine work, special consideration was given personality study, in accordance with the revision made of proceedings and development along more comprehensive lines.

The series of papers alluded to above covers the entire study from descriptive psychology to and including personality study. The subject matter has been assembled from numerous sources and is presented in the form believed best suited to the needs of the flight surgeon and student within the limited time at his disposal.

The paper on personality study treats of: (*a*) The meaning of per-

sonality; (*b*) the purpose of personality study from the flight surgeon's viewpoint; (*c*) procedure in making personality study; (*d*) classification. Each of these topics is elaborated in minutest detail with a wealth of material covering the subject from every point of view.

In ophthalmology and otology at the laboratory, further work on the perfection of ear plugs has been done, and several hundred plugs have been sent out to the various flying fields. A report of this work, together with a description of the method of making the plugs, has been prepared by Major Tefft and Miss Stark and will be published shortly.[4] There are two types of plugs, one for summer use and the other for winter use, the difference being in the consistency of the plugs. They are manufactured from a mixture of beeswax and parresine on a core of lamb's wool. The plugs seem to keep out satisfactorily all the noise from the roar of the motor without interfering with the ability of the pilot to detect a skipping in his engine. They eliminate the temporary deafness which always results after prolonged rides in any plane or short rides in bi-motored planes.

A study of the "speed of accommodation" in relation to the various phases of the eye examination given to fliers has been completed on sixty subjects, and a paper entitled "The Speed of Accommodation as a Practicable Test for Fliers," by Major Tefft and Miss Stark, is now ready for publication.[5]

The apparatus used in determining the speed of accommodation is the tachistoscope developed in 1918 by Prof. C. E. Ferree of Bryn Mawr College. It is devised so that three test letters (two near, one at the left, the other at the right, and one far in the middle) are exposed simultaneously to the observer and are then cut off from his view one at a time in a fixed order. This is done by means of three sets of aluminum discs "of variable open and closed sectors turned by means of a bar fastened at its center to the axle to which the discs are attached and provided with adjustable weights on both arms." The two sets of discs which expose and exclude the near test letters are attached to the axle at the same point, but the one for the left letter is of shorter radius. The third set of discs controlling the exposure of the far test object is fastened to the axle behind the near test cards. "The length of exposure can be varied either by changing the width of the open sector or the position of the weights on the arm" of the bar.

The system of discs with the propelling bar operates behind a cardboard screen fastened to the framework of the apparatus. At the level

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[4] The Use of Ear Plugs in Aviation. Tefft and Stark. Annals of Otology, Rhinology and Laryngology, No. 2. vol. xxxi, 1922.

[5] Speed of Accommodation as a Practicable Test for Fliers. Tefft and Stark. Am. Jour. Ophth. vol. 5, No. 5, 1922.

of the test objects a narrow slit is cut in the screen through which the observer views the test letters.

The test letters are the illiterate E's mounted so that they can be rotated to point in the different directions, up, down, right and left. The height of the near E is 0.8 mm., that of the far one 11.7 mm. Illumination for the near test cards is provided by a tubular tungsten lamp fastened to the top of the frame of the apparatus. This throws the light on the back of the cardboard screen, and from there it is reflected to the test cards. Direct illumination on the far test card comes from a tungsten lamp mounted in a reflector.

In giving the test, the subject is seated 30 cm. from the near test objects and 6 meters from the far one, with his head held in position by a Troland head-rest. After a completed exposure he is required to report the direction in which each of the E's points. In order to perceive these successfully, he must first focus on the near E at his left, then adjust for the far E in the center, and finally accommodate for the near E at his right. After a short practice period, the exposure times for each letter are gradually shortened until the subject's maximum speed is obtained. The various exposures—near, near to far, near to far and back to near—are recorded in terms of degrees of open sector and later converted into time by a process of calibration.

In view of the following facts it is not recommended that the test for speed of accommodation be incorporated at this time in the 609 examination. The apparatus in its present form is cumbersome and its operation requires too specialized a technique for use in a routine examination. Many subjects find difficulty in adjusting to this particular test situation. The memory factor seems to be almost as important as proper eye functioning. The test, as given, undoubtedly places much greater strain on the eyes than is required in any flying situation. Finally, with the exception of presbyopic cases, those who possess a slow speed of accommodation seem to possess other visual deficiencies which can be more easily detected.

In psychology the following work has been accomplished. The statistical study of types of motor responses shown during the first three minutes of the rebreathing test was extended to include 600 records from other flying fields, in addition to the 600 records originally used. Comparisons between the groups selected according to the type of response were made with respect to the character, quality and length of run, and the final oxygen, rating and score. The completion of this work was hindered by the fact that a large part of it was destroyed by fire and water, and the material had to be reassembled, recalculated, and the curves redrawn. The study is now complete.

The majority of reactors present a type of motor response which is steady, slow and accurate, in contrast to the other large group of reactors whose responses are impulsive, hesitant and inaccurate. Comparisons of these two classes show the former to be superior in every way. The initial failure of attention and the ability to coordinate properly and the complete failure of these faculties occur later and at lower oxygen per cent than is the case in the second group; the run is of longer duration and the final oxygen per cent is lower. Of the first group, 60 per cent are rated "A," 31 per cent "B," and 8 per cent "C," as compared with the second group of which 30 per cent are rated "A," 48 per cent "B," and 22 per cent "C." In as far as ability to preserve his attention and voluntary control at altitudes, as shown by the rebreathing test, is concerned, these results indicate that the reactor whose responses are steady and accurate is superior to the one who shows impulsive, hesitant and inaccurate tendencies.

By the Departments of Aviation Psychology and Aviation Physiology of the Laboratory, a statistical study of the relationship between pulse increase, respiration response, final oxygen, and the oxygen percentage at which complete failure of motor coordination and attention occurred, as shown on the rebreather, was completed. From the same records another study was made of the final oxygen to (1) systolic increase, (2) diastolic increase, (3) pulse pressure increase, and (4) respiration response. The results of these two studies have not yet been written.

A paper called "Monocular and Binocular Judgment," based upon data collected by Capt. B. H. Palmer, formerly of the Ophthalmology Department, was written by Miss Deyo and will be published shortly.[6] The subjects, who were army officers and men, were given the routine eye examination for flyers, which included the visual acuity for each eye, the angle of convergence, judgment of depth perception using binocular vision, and, in addition, judgments of depth perception using monocular vision. There are such great differences in judgments of depth perception made with monocular vision and with binocular vision (the former being uniformly poorer) that it is evident that good binocular vision is necessary for accurate judgment of distance, and the results show that the better the visual acuity the more accurate the depth perception judgments tend to be.

Greene and Gilbert during the past year have added to their series on the effects of low oxygen as evidenced by electrocardiogram. They have published one paper on a case which they had while still at the

[6] Monocular and Binocular Judgment of Distance. Barbara V. Deyo. Am. Jour. Ophth. vol, 5. No. 5, 1922.

Medical Research Laboratory. This case was carried to an extreme, and their findings are interesting. To quote direct from their own paper the case showed:

An additional and extreme case of oxygen deficiency on the normal human subject showing changes in the heart during a rebreather test is presented with continuous electrocardiograms through the crisis and post-crisis periods. The data show:

1. That reflex muscular control in the human may persist six to eight seconds after loss of consciousness from anoxemia.
2. That sino-auricular rhythm is lost by steps first to a lower point in the sino-auricular system, second to a point nearer the base of the ventricle, presumably the auriculo-ventricular node.
3. That internodal conduction is finally lost, a brief stage of reversed conduction terminating in lengthening R-P intervals precedes total loss of conduction.
4. That the ventricular rhythm is very persistent and unexpectedly regular during the late post-crisis stage. In this case the equivalent rates are from 63 to 44 increasing to 48 per minute in ten seconds after removal of mouth piece.
5. That in man lack of oxygen induces a series of changes in cardiac rhythm, in conduction and in suppression of auricular contractions quite parallel to similar phenomena established in experimental animals under general asphyxiation.

They have also done considerable work with dogs to determine the causes of changes observed in the heart during extreme anoxemia, but as they will present a paper on that subject today I will not go into it.

FURTHER OBSERVATIONS ON A CARDIOVASCULAR PHYSICAL FITNESS TEST[1]

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THE CALL for a measure of physical fitness comes from the medical officer who has the responsibility of determining whether or not the aviator is fit to fly, from the industrial plant concerned in the efficiency and welfare of the workman, from those in our colleges and universities who are responsible for the condition of athletes who are to participate in athletic contests, from those who are directing the work in physical education, and from the practitioner of medicine who desires to know what progress his patient is making toward restored health.

In industry and aviation the information as to the physical fitness of the individual makes it possible to take steps to increase well being, contentment and efficiency and to decrease chronic fatigue and discontent. In aviation it may also mean the saving of lives and aeroplanes.

The question of what is involved in physical fitness or unfitness is somewhat vaguely answered today by available information. There has been a tendency to use a number of terms and expressions rather loosely and interchangeably in the discussion of fitness. Hence we read discussions of athletic condition, physical fitness, physical efficiency, physical development, fatigue, chronic fatigue, staleness, nervous fatigue, nervous prostration and neuro-circulatory asthenia, which deal with physiological problems that appear to be more or less allied and to some extent identical. That it is difficult to define any of the above expressions is evident when an attempt is made to define the word fatigue—a word widely and freely used. It has been defined as the "sum of the results of activity which show themselves in a diminished capacity for work." The dominant conception is that there occurs a progressive flagging of efficiency, a decrease in the ability to respond to stimuli.

On the other hand, there are fatigue conditions, included in the above expressions, in which there seems to be a lowered threshold for sensory stimuli of all kinds; the resistance normally interposed by the higher nervous centers on the reflex-arc seems to be weakened or absent, so that the organism responds with a useless expenditure of physical and mental activities. It is a common observation that an overwrought or overworked individual may not be conscious of being tired and that he

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[1] Read at the Fourth Annual Meeting of the Air Service Medical Association of the United States, St. Louis, Mo., May 23, 1922.

gives evidence of his fatigue in inability to relax and keep still. It appears, therefore, that so-called fatigue may result in either an increased or a decreased resistance to the transmission of sensory stimuli throughout the central nervous system. Fatigue as ordinarily spoken of is a negative quantity, a diminished capacity for work; and yet some unusual necessity or new interest may drive an individual on past the place he would naturally stop because of fatigue, with the result that soon his output is as good or better than at any time during the work period; he has apparently been able to tap a new level of energy and has forgotten his so-called fatigue. The difficulties of definition have led Muscio to suggest that the term "fatigue" be absolutely banished from precise scientific discussion.

While it must be admitted that there are difficulties in arriving at an adequate definition of such terms as fatigue, staleness, nervous prostration and the opposite condition, physical fitness, yet, in view of recent progress in the study of the physiology of the general problem of fitness and fatigue, we must for the present retain them in our vocabulary. The functional differences observed between active and inactive species of animals and between the physically trained and untrained men leave no doubt but that fitness and health are based upon profound physiological changes that apparently involve almost all the tissues and organs of the body.

The functional changes of the body brought about by regular training give the basis for a number of physical fitness tests. All of the proposed tests of fatigue and fitness have been classified under two main heads, performance tests and non-performance tests. The performance test requires a subject to do something in which the character of the work is regarded as the indicator. In the non-performance test measurement is made of certain involuntary phenomena, the character of which is regarded as a possible indicator. The non-performance test usually requires some effort from the subject, but the observer's attention is centered upon the involuntary response and not the character of the effort.

According to Muscio the performance tests should be abandoned because none of them yield results that do not require interpretation and correction for such interfering factors; as (*a*) incitement, (*b*) practice, (*c*) spurts, (*d*) diurnal rhythm, (*e*) incentives to a given kind of activity, and (*f*) competing incentives.

While the non-performance tests are, as a rule, not affected by the above interfering factors, yet they too are subject to the influence of disturbances, chiefly the emotions. All of the non-performance laboratory tests include observations on one or more of the following con-

ditions: the variations in the pulse rate, arterial blood pressure, skin reaction, physiological reflexes, psycho-galvanic reactions, excretions, muscle tonus and metabolism. Because physiology has not as yet, for any single function, shown all the factors that may influence these involuntary phenomena, not one of the devised tests is entirely satisfactory. Furthermore, the present indications are that while the non-performance tests are best, nevertheless none of them can be perfected so as to give a simple, short, trustworthy test. It requires considerable care and time to eliminate the possible known disturbing factors.

A number of new tests for physical fitness have recently come into use. One of these belongs to the performance group and has been quite favorably received. It is known as Martin's resistance strength test and embodies the separate determination of resistance offered by five pairs of muscles to a pulling force, which is registered by a dynamometer. The sum of the power of the ten muscles is multiplied by a constant to estimate the total functional capacity of the musculature. Burton-Opitz says of the muscular strength tests that "the power of the muscles under examination cannot be accepted as a criterion for estimating the functional capacity of the musculature as a whole. Consequently, these tests cannot yield exact results pertaining to the condition of the body as a whole unless various sources of error have been carefully guarded against."

Briggs, by the use of the methods of calorimetry, has developed a test of fitness in which he distinguishes between a normal load and an overload during a muscular performance. He defines a normal load as one during which the oxygen supply is sufficient and an overload one during which it is insufficient to supply in full the demands of the working muscles. When the supply of blood and oxygen is inadequate, lactic acid appears in the blood and the production of carbon dioxide falls off proportionately. He, therefore, assumes that the rate of work corresponding to the maximal output of carbon dioxide in the expired air is the boundary between an overload and a normal load. If muscular work be increased beyond this, the carbon dioxide output decreases. By a comparison of the percentage curves of exhaled carbon dioxide when, during increasing amounts of work, the subject breathes air and again when he breathes oxygen, it is found that fitness varies inversely as the divergence of the two carbon dioxide curves. With air enriched with oxygen the unfit man increases his capacity for work while the fit man gets little benefit from it, apparently because for him the supply of oxygen has been adequate. The failure of the body to supply sufficient oxygen for work gives the unfit, as compared with the physically

fit individual, a handicap that eventually results in limiting the foot-pounds of work.

A number of fitness tests are based upon circulatory observations, in recognition of the fact that the distress of the individual in poor training may be due to a failure of the heart to meet the demands of the body for oxygen and nutrients. Two of these tests confine attention to the arterial blood pressure. Pachon's blood pressure test requires the determination of the systolic and diastolic arterial pressures during physical exercise. It is maintained that in the well-trained man both of these pressures rise early and maintain a plateau during the work period and afterward quickly return to normal, but never go subnormal. In the untrained person these pressures do not maintain the plateau during the period of work but diminish after awhile, and even sometimes return to normal or go subnormal. Following the exercise, the systolic pressure falls much below normal and the diastolic pressure slightly so. The extent of these failures, it is believed, indicate the degree of unfitness.

In Barringer's blood pressure test the subject, during a series of observations, is required to do increasing amounts of work to determine the least amount of effort that will result in a "delayed rise" in the systolic pressure after the cessation of exercise. Immediately after each effort the systolic pressure and the pulse rate must be determined simultaneously; they are determined again a half minute later, and then at minute intervals until they return to normal. It is claimed that in the physically fit subject the systolic pressure is maximal immediately after exercise, while in the unfit it becomes so some time later ("delayed rise"). In the way of criticism it has been pointed out that in perfectly healthy men ten seconds after the end of a short period of vigorous exercise the systolic pressure is near the resting normal, and that it then rises rather rapidly and reaches a maximum twenty to sixty seconds later. However, a study by Mann of cases during convalescence from infectious disease appears to support Barringer's contention that a delayed rise indicates an overtaxing of the heart's reserve power.

Both the Pachon and the Barringer tests should give valuable information regarding the condition of the heart muscle. It is doubtful whether or not a heart strength test gives an index of the body as a whole and whether such a test may be serviceable to determine grades of fitness. By them we may learn the degree of work that will overtax the heart.

Other fitness tests are founded on pulse rate differences noted between trained and untrained individuals and the systolic blood pressure difference that results when the posture is changed from reclining to

standing. All available evidence indicates that with improvement in physical fitness the heart beats less frequently and more efficiently. A slow pulse in recumbency and standing, with a small difference between the two, is usually a sign of excellent health. Others find that the increase in the pulse rate in exercise and the time required for the rate to return to normal after exercise are less in the well-trained person, and that the systolic blood pressure falls in the standing posture in persons weakened by dissipation, overwork, lack of sleep and disease.

For the purpose of aiding the flight surgeon in judging the fitness of aviators, a point system of grading these cardiovascular reactions was proposed in 1919 and was adopted in the army aviation medical service.

This point system used for grading physical fitness weighs data from six sets of observations; viz., the pulse rate during recumbency, the pulse rate during standing, the increase in the number of beats in the pulse rate when the standing and reclining postures are compared, the acceleration of the pulse rate after a standard exercise, the time required for the pulse rate to return to normal after exercise, and the change in the systolic arterial blood pressure when the change is made from recumbency to standing. The scheme of scoring was adopted instead of a percentage rating in order to avoid arousing the resentment of the subject under observation in case he fell decidedly below the average. It is an arbitrary setting of values but has served the purpose desired.

The test was described in detail in the Journal of the American Medical Association, 1920, Vol. 74, pp. 1507–1510. The tables and directions for making the required observations for grading are again presented. A perfect score, the sum of the values given to each of the six items, is 18.

TABLE I.—POINTS FOR GRADING CARDIOVASCULAR CHANGES

A. Reclining pulse rate		B. Pulse rate increase on standing				
Rate	Points	0–10 Beats, points	11–18 Beats, points	19–26 Beats, points	27–34 Beats, points	35–42 Beats, points
50– 60	3	3	3	2	1	0
61– 70	3	3	2	1	0	−1
71– 80	2	3	2	0	−1	−2
81– 90	1	2	1	−1	−2	−3
91–100	0	1	0	−2	−3	−3
101–110	−1	0	−1	−3	−3	−3

C. Standing pulse rate		D. Pulse rate increase immediately after exercise				
Rate	Points	0–10 Beats, points	11–20 Beats, points	21–30 Beats, points	31–40 Beats, points	41–50 Beats, points
60– 70	3	3	3	2	1	0
71– 80	3	3	2	1	0	0
81– 90	2	3	2	1	0	−1
91–100	1	2	1	0	−1	−2
101–110	1	1	0	−1	−2	−3
111–120	0	1	−1	−2	−3	−3
121–130	0	0	−2	−3	−3	−3
131–140	−1	0	−3	−3	−3	−3

E. Return of pulse rate to standing normal after exercise		F. Systolic pressure, standing, compared with reclining	
Seconds	*Points*	*Change in Mm.*	*Points*
0–30	3	Rise of 8 or more	3
31–60	2	Rise of 2–7	2
61–90	1	No rise	1
91–120	0	Fall of 2–5	0
After 120: 2–10 beats above normal	−1	Fall of 6 or more	−1
After 120: 11–30 beats above normal	−2		

DIRECTIONS FOR PROCEDURE IN THE CIRCULATORY EFFICIENCY TEST

Preliminary: Subject reclines for five minutes.

1. Heart rate is counted for 20 seconds. When two consecutive 20-second counts are the same this is multiplied by 3 and recorded.

2. The systolic pressure is taken by auscultation and recorded. Take two or three readings to be certain.

3. The subject then rises and stands for two minutes to allow the pulse to assume a uniform rate. When two consecutive 15-second counts are the same, multiply by 4 and record. This is the normal standing rate.

4. Standing pulse minus the reclining pulse gives the increase on standing.

5. The systolic pressure is taken as before and recorded.

6. Timed by a stopwatch, the subject steps upon a chair 10½ inches high five times in 15 seconds. To make this uniform the subject stands with one foot on the chair at the count one. This foot remains on the chair and is not brought to the floor again until after count five. At each count he brings the other foot on the chair and at the count "down" replaces it on the floor. This should be timed accurately so that at the 15-second mark on the stopwatch both feet are on the floor.

7. Start counting the pulse immediately at the 15-second mark on the stopwatch and count for 15 seconds. Multiply by 4 and record.

8. Continue to take pulse in 15-second counts until the rate has returned to the normal standing rate. Note the number of seconds it takes for this to return and record. In computing this return count from the end of the 15 seconds of exercise to the beginning

of the first normal 15-second pulse count. If the pulse has not returned to normal at the end of two minutes record the number of beats above normal and discontinue counting.

9. Check up points and enter final rating.

10. Enter history of case, including amount of sleep, amount of smoking, kind of work (outdoor or indoor, active or sedentary, etc.), time since last meal, any personal worries or any pathological condition which might affect the condition of the subject.

Experience has shown that it is important to have the person who serves as the subject of the test mentally at ease. This is best accomplished when the room is quiet and no spectators are present. In an attempt to eliminate psychic circulatory response it has been found that the inflation of the sphygmomanometer cuff several times during the five minutes of rest or engaging the subject in topics of conversation concerning the laboratory, have proved useful in overcoming these mental effects.

If the test is to prove satisfactory, it must be conducted by exactly the same procedure at all times and the time intervals strictly adhered to. It is important that the subject be at ease during the entire period of observation and that plenty of time be allowed for the establishment of equilibrium in the pulse rate and blood pressure for each posture. However, an occasional weak subject, if allowed to stand still too long, is inclined to develop the fainting circulatory reaction, in which case the systolic and diastolic arterial pressures will be found to be gradually falling.

Carelessness in determining the pulse rate immediately after the standard exercise is especially to be deprecated. The pulse quickening in exercise and the time required for the pulse to return to normal after exercise give two very important clues to the degree of physical unfitness. For this reason the counting of the pulse should begin immediately with the cessation of exercise and not be prolonged beyond the 15-second interval first recommended. Experience has shown that Table E (return of the pulse rate to standing normal after exercise) was not as satisfactory as the other five tables of rating. In all the other tables a grade of 3 points is only given to the exceptionally good showing, while in E the high score of 3 points was allowed for the average condition.

The time required for the pulse rate to return to normal after exercise was determined for a group of 217 cases selected at random. Of these 11 per cent were back in 15 seconds, 5 per cent more in 30 seconds, 18 per cent more in 45 seconds, and 11 per cent more at 60 seconds; in all 45 per cent of the cases had returned to normal or become subnormal in 60 seconds. In a statistical study of 2,000 cases there were 35.9 per cent of the men with a recumbency pulse rate of 70 or less, the rate for

which 3 points are allowed; only 18 per cent had a standing rate of 80 or less; an increase of not more than 10 beats in pulse rate occurred in 25.8 per cent; and a systolic pressure rise on standing of 8 mm. or more occurred in 29.6 per cent of the cases. These are the requirements for a grade of 3 points in the other five conditions that enter into the scheme of rating. In order, therefore, that more use may be made of the pulse return after exercise, table E has been changed to read as follows:

TABLE E.—RETURN OF PULSE RATE TO STANDING NORMAL AFTER EXERCISE

Seconds	*Points*
0–30	3
31–60	2
61–90	1
91–120	0
After 120: 2–10 beats above normal	—1
After 120: 11–30 beats above normal	—2

It has been suggested that the exercise prescribed by this test is not enough. To increase the work three or four fold by raising the body 15 or 20 times in 45 or 60 seconds would not necessitate changing the tables for grading and might bring out more strikingly a lack of condition. We have found that for the individual in good condition the pulse is not accelerated much more and the return to normal is made promptly when the exercise is continued for 45 seconds. Some subjects claim that the effort required to raise the body to a standing position on the chair is greatly increased after the number of lifts exceed ten. It is questionable whether the gain obtained by increasing the amount of work actually adds information that is not given by the amount of work originally prescribed. It is essential in either case that the pulse count be started immediately exercise ceases.

The diurnal variations in the final score have been determined on seven men and seven women, three of whom served as subjects on two occasions. The test was made once an hour from 9 a. m. one morning to the same hour the next morning. During the daytime each subject kept busy with desk work and ate the usual meals. The arithmetical mean of the scores for each hour was calculated separately for the men and the women and the curves plotted. The mean score for the men for the 24 hours ranged from 10.1 to 13.6 and for the women from 9 to 14. These curves were similar, that of the women being smoothest. The large fluctuations were due to the ingestion of food. The score rose steadily from early morning to 12 o'clock noon; but following lunch at 12.15 the score began to decline and reached its lowest value for the day by 2 o'clock, after which it again rose until 5 p. m.; the evening

meal which was taken at 6 o'clock by some of the subjects and at 7 o'clock by others, caused another fall, but not as great as that following the noon meal. From 8 p. m. to 2 a. m. there occurred a steady rise, the maximum score for the day occurring at 2 a. m. After this there was a slight fall.

There are certain things that may temporarily give a low score, and these should be guarded against when the test is used to determine physical fitness. The effects of meals have already been alluded to. Almost invariably they caused a lowering of the score, chiefly by accelerating the pulse beat in both the reclining and standing postures, but mostly in standing and after exercise. In the standing position the systolic pressure frequently fell, and when it did not the increase was less than ordinary. The effect of eating was noticeable for about an hour but sometimes lasted fully two hours. The decline often was as much as 8 points, the average being about 4 points. An attempt made to analyze the cause of the change has not been successful. The size of the meal did not seem to determine the degree of change. Coffee was apparently not responsible. Oddly chocolate in any form seemed to cause a slight fall.

As was to be expected, the after effects of exercise resulted in a lowering of the final score, the effect lasting two or three hours in several instances. Most of our observations were made after 30 minutes of tennis and in some of these cases the effects quickly passed away, while in others they lasted several hours; the score having been lowered by as much as 10 points would gradually rise until the normal was restored. Following a warm bath the score is also lowered. The effects of smoking were found to differ with individuals, but were, of course, most in evidence on those least accustomed to it. The most conspicuous change was a fall in the systolic pressure on standing, but there was also a quickening of the pulse, especially so on standing. The effects were temporary and usually disappeared within one and one-half hours. Even the heavy smoker gave the reaction if he smoked two cigars.

Some temporary indispositions also lower the score. Thus one case of diarrhea, which lasted only a part of a day, lowered the score ten points; the standing and after exercise pulse was quickened and the standing systolic pressure showed a fall. A throbbing toothache also lowered the score by increasing the several pulse rate counts. The discomforts of marked flatulence and also a temporary feeling of indigestion were responsible for a lowering of the score by quickening the standing pulse and a lessened response, or a failure, of the standing systolic pressure compensation. The loss of one night's sleep does not usually manifest itself the next morning, but it may do so, and to go without

sleep the greater part of two nights in succession is certain to result in a lowering of the score.

It is evident from this statement of the influence of a variety of physiological reactions on the final score that, in using the test to determine physical fitness, some attention must be given to the choice of the time of day for observation and that the subject of the test should be instructed not to smoke, eat or exercise for the two hours preceding the test.

Acute infections and prolonged illness always lower the score very much. The results published by Captain Scott are now supported by other available records.

The effects of consistent physical training invariably result in a higher score, but it sometimes requires as much as a month of exercising to make a clear cut change. In men who persist in keeping late hours and in the use of intoxicating liquor the improvement is not as great as might be expected. The discontinuance of training and all exercise after a season on a football squad was responsible in the course of several months for some lowering of the score through a quickening in the pulse rate.

When the tables were first prepared for this scheme of rating fitness we were not thinking of applying them to women. However, a limited experience with a group of women at the Medical Research Laboratory has shown that they may also be used in rating the physical fitness of women. Thus far the women have made scores that ranged as high and as low as any obtained with men. They also show about the same average as men engaged in sedentary work.

THE OXYGEN EXHAUSTION OF THE BLOOD AS A FACTOR IN FLIGHT LIMITATIONS[1]

By Major CHAS. W. GREENE, Sanitary O. R. C., University of Missouri, Columbia, Mo., and CARL H. GREENE, M.D., Late First Lieutenant, Chemical Warfare Service, Rochester, Minn.

THE MAINTENANCE of the physical efficiency of the aviator is the chief problem of the Air Service Medical Association. Efficiency must be maintained not only under the usual conditions of ground-work but also under the more strenuous conditions of flying at all altitudes up to and including the limits of human endurance. The problems of altitude physiology are therefore peculiarly the province of this assembly.

A long series of investigations of these problems, beginning with those of Paul Bert in 1872 and ending with the brilliant studies from the Medical Research Laboratory of the Air Service, have shown that the lack of oxygen at high altitudes is responsible for the disability of the flyer. The physiological and mental effects of oxygen want are definitely due to a failure of the oxygen supply to the brain and vital organs. The reasons for the failure of the aviator must be sought in the mechanisms regulating the supply of oxygen to the tissues, i.e., the respiratory and circulatory systems and the blood. We have investigated and report here the changes in the oxygen content of the blood, as our particular contribution to aviation medicine.

It is the hemoglobin in the blood that actually carries the oxygen to the tissues, and it is to the changes in the total oxygen content of the blood that we must look for the explanation of the casual factors in the compensatory reactions to altitude and the resulting anoxemia.

The changes in the oxygen content of the blood of dogs were studied during progressive anoxemia produced by the Greene and Gilbert modification of the aviation rebreather test adapted to dogs. In contrast to the aviation tests the dog experiments were carried to the point of complete respiratory failure and death. It should be noted that the dog is much more resistant to oxygen want than is man. Several animals in our experiments were able to maintain respiration and circulation with but 2 per cent of oxygen in the inspired air. This corresponds to an equivalent altitude of approximately 50,000 feet or far above any present-day altitude record.

It was formerly believed that part of the process of acclimatization to altitude was due to the epithelium of the lungs acquiring the power of actively secreting oxygen into the blood from the alveolar air. This

[1] Read at the Fourth Annual Meeting of the Air Service Medical Association of the United States; St. Louis, Mo., May 23, 1922

theory was based upon an indirect method of determining the oxygen content of the blood. We have reinvestigated this problem, using direct and highly accurate methods of analysis, and have found no evidence of such secretion. The degree to which a hemoglobin solution becomes saturated with oxygen when shaken with different gas mixtures depends primarily upon the oxygen tension present. The curve of Barcroft and Camis for the dissociation of dog's blood represents the maximum amount of oxygen the arterial blood can contain at any altitude provided only physical mechanisms regulate the absorption of oxygen in the lungs. Our direct determinations of the oxygen in the arterial blood show that the arterial saturation parallels but does not exceed that calculated from the dissociation curve.

In the normal individual the arterial blood is saturated with oxygen to the extent of 95 to 96 per cent oxygen. About 30 per cent of this oxygen is used during the passage of the blood through the tissues. The venous blood, therefore, is still nearly 70 per cent saturated. This represents an excess of oxygen in the blood over that required by the tissues—a true venous reserve. As the arterial oxygen is decreased during rebreathing the venous oxygen likewise falls, the two curves closely paralleling each other.

The total amount of oxygen required per minute by the body is apparently independent of the altitude. As long as the blood maintains the supply of oxygen to the tissues there is little or no change in their physiological activity. The difference between the oxygen content of the arterial and the venous bloods is a measure of the oxygen consumption by the tissues. The normal level of oxygen consumption is unchanged during the greater part of the course of the rebreather experiments. With the progressive reduction in the oxygen tension of the air breathed there is a progressive fall in the arterial oxygen. The oxygen utilization is unchanged, and hence the anoxemia manifests itself only in a progressive reduction in the reserve oxygen of the blood, i. e., the venous oxygen content. The tissues have the power of utilizing all the oxygen furnished by the blood. At least at oxygen tensions of 30 to 40 mm., or 4 to 5.5 per cent, of oxygen in the alveolar air the venous blood is completely anoxic, or is so nearly so that our analytical methods will not determine the residuum of oxygen.

The dog, or man either, is in good condition until the stage of complete venous anoxemia is produced. Any further reduction in the alveolar oxygen tension produces profound reactions. At this critical stage the arterial oxygen falls below the normal level of oxygen consumption and asphyxiation of the tissues becomes imminent. The normal quantity of blood will no longer supply sufficient oxygen to

the tissues. Physiological function can be sustained only by an increased blood flow in order to maintain the oxygen supply. It is at this point that the circulatory reactions are most pronounced. The cardiovascular system responds by an increased pulse rate, a heightened blood pressure and an increased pulse pressure. These all are evidences of an increased blood flow or circulation rate. Respiratory compensations also occur but are less important. In the "pre-crisis" stage of anoxemia the burden of compensation is placed directly upon the heart. If the heart is not equal to the strain or if the load is increased by a further reduction in the alveolar oxygen tension then tissue asphyxiation and collapse follow.

From a consideration of the experimental data it is apparent that the compensatory reactions to anoxemia are determined by the oxygen exhaustion in the blood. Nevertheless the brunt of the compensation to anoxemia, and so to altitude, is borne by the circulatory system. A wide margin of safety is provided by the oxygen reserve of the blood evidenced by the venous oxygen content. Even this margin of safety is greater in individuals of a high degree of circulatory efficiency. The acclimatization to altitude therefore is largely one of increased ability of the cardiovascular system to withstand the strain resulting from the anoxemia. Altitude has an effect very similar to that of severe physical exercise, and the acclimatization of the aviator is entirely analogous to the training of the athlete.

The methods of maintaining the maximum degree of physical efficiency in the aviator and of its determination will be presented in other papers of the program and need not be discussed now.

AN EXPERIMENTAL ANALYSIS OF THE CAUSE OF THE OCCASIONAL FAINTING AND COLLAPSE IN THE OFFICIAL AIR SERVICE TEST[1]

By Major CHAS. W. GREENE, Sanitary O. R. C., University of Missouri, Columbia, Mo., and Lieut. Col. N. C. GILBERT, M. O. R. C., Northwestern University Medical School, Chicago, Ill.

THIS audience is only too familiar with the rebreather method in the altitude examination of the Air Service. The system of rating of the level of safe altitude in flight of aviators was determined on the basis of the effect of gradual reduction in content of oxygen in the air breathed. These ratings took into account the reactions of the respiratory, circulatory and ocular systems. Most candidates were taken off the test because of failure of muscular coordination, or of mental perception. It was a matter of common knowledge that collapse of these two functions occurred rapidly and practically simultaneously. Occasionally, however, individuals suddenly collapsed. They became immediately unconscious, showed low blood pressure, weakened respiration, and even complete muscular relaxation. Recovery from these states of unconsciousness was accompanied by some faintness and slight headache but always without memory of events during the lapse of consciousness.

From early in the history of the Research Laboratory there had been a sharp question as to the condition of the heart at the end of the ordinary examination, and especially in these fainting cases. Dilation had been described, and it was feared that permanent damage might be done by the examination itself. It was to get more data on this topic that the series of special experiments with electrocardiograms was organized with the approval of the commanding officer.

The detailed results of these experiments have been published in the journals and reprinted in the *Air Service Circular*. However, we call attention to certain outstanding points. A selected group of slides is shown to review the usual method of graphing the respiratory volume, systolic pressure, diastolic pressure and heart rate. These cases are chosen to demonstrate extreme effects. You will notice that at the close of the test the heart rate dropped suddenly if the test was carried to the maximum limit of unconsciousness. Most tests were stopped short of this limit by examiners during official examinations.

The electrocardiograms revealed the associated changes in the heart. During extreme slowing of the heart the auricular contractions dis-

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[1] Read at the Fourth Annual Meeting of the Air Service Medical Association of the United States, St. Louis, Mo., May 23, 1922.

appeared, though the rhythm remained constant. When the heart reached a dangerous slowing the auricle failed entirely and the question arose as to the nature of the changes induced. The answer was not secured from men.

In one case the test was carried to the point of unconsciousness and just to the stopping of respiration. The heart rate under these circumstances dropped from 136 to 44 per minute in the space of 20 seconds. We have published graphic charts showing the suddenness in the change of rate. A few artificial respirations were used on this man, but natural respiration was immediately established and consciousness was regained in 40 seconds. There were no after effects other than a slight dizziness and headache.

The electrocardiograms show the profound changes in the character of the human heart beat. These changes are:

1. Sudden and extreme slowing.
2. Inversion of the P wave, showing descent of the rhythmic center.
3. Inversion of the beat, i. e., ventricle followed by the auricle.
4. Cessation of auricular contraction with complete block.
5. Persistance of ventricular rhythm.

These tests on man show that when the examination is pushed beyond the stage of inefficiency to that of total unconsciousness the heart does not merely get slower in rate but that the normal rhythm is tremendously disturbed.

Further studies were made on dogs. A laboratory spirometer was modified into a miniature rebreather for the dog. Dogs were chloretonized as lightly as possible, tracheotomized, and blood pressure, respiratory, and electrocardiographic records were taken simultaneously throughout a series of tests sometimes carried to the death of the animal. Dogs manifest the same pressure and cardiac changes at the crisis that are shown by men. We do not know from the early experiments when unconsciousness came, but by later tests we judge it to be at about the point where electrocardiographic irregularities begin.

The crucial test as to nerve versus heart asphyxial effects consists in freeing the heart from vagus control. This we did by cutting the vagus nerves. We published in the *American Journal of Physiology*, vol. 60, page 190, an enlarged photograph giving the heart rates, blood pressure, etc., at the time of cutting the nerves in a typical experiment, No. 40. The respirations stopped at the beginning of the period of cardiac slowing. When the first vagus nerve was cut no apparent change of heart rate occurred. When the second nerve was cut the rate again became extremely rapid. During this cycle the heart rate dropped from a maximum of 161 down to 44, compared with the human

case of 136 to 44. When the nerves were cut the rate returned back to 184, then slowly decreased under continued asphyxiation until the death of the animal several minutes later.

In the electrocardiographic tracings in this dog the main points are:

1. Great slowing of the rate within the space of a very few beats.
2. Reversal of the rhythm and suppression of conduction.
3. When the first nerve, the right, was cut, rhythm temporarily returned but conduction was quickly blocked. This we know to be due to a dominant left vagus effect.
4. When the second nerve, the left, was cut, the heart rate was immediately reestablished at the high level, and the contractions became absolutely normal and sequential in character.

No one could escape the conclusion that in both the men and dogs the slowing of the heart at the crisis of the rebreather examination is due to an anoxemial effect on the medullary vagal centers. It is a true vagospasm. That it is due to lack of oxygen and not to excess of carbon dioxide is also without question.

Reinterpreting, it is obvious that several of our earlier men were far along in the production of vagospasm when the tests were discontinued. In the one outstanding case the test was still nearer the terminal danger point. However, the dogs also show that with facilities for the supply of oxygen by artificial respiration or otherwise, recovery is absolutely prompt and apparently without danger. The working time, however, is short, usually but two or three minutes at most. After this critical stage even dogs are not easily revived, though supplied with pure oxygen.

The tests are remarkably constant as regards the percentage of oxygen at which a given individual man or dog shows the critical changes and loss of consciousness. The nervous system is the most sensitive to oxygen want both from a mental point of view and from that of a motor mechanism. The tests for mental inefficiency and control, and the evidence of loss of neuromuscular control, are the most reliable and vital signs by which to judge the safety limit in the rebreather method. Whatever the respiratory or circulatory responses, or changes in the blood oxygen content, the end will be reached when nerve and muscle coordinations are lost.

It is a matter of gossip among fliers that many of the classification ratings taken into the field were ignored by the combat officers. Often the ratings reached the aviator, classifying him on a certain level, when he had already made flights at a higher altitude. These were matters of discredit to the science. The question is: Were they not chargeable to the wide arbitrary margin of safety established by the

method of rating? Our whole series of studies, of which we have reported only a brief number, have converted us to an entirely different attitude toward the classification of ratings of candidates tested by the method of the rebreather test. It has seemed to us that it would be far better, as a matter of medical procedure, to determine the calculated altitude at which aviators become inefficient and then rate them directly to their maximal altitudes. We are confident that few aviators could or would try to fly beyond the height at which they became inefficient in the rebreather test. A few predicted field accidents would create a more wholesome attitude of the combat arm of the service toward this vital special medical technique.

Finally, the altitude rating of the aviator, as everyone knows, is valuable not in limiting his altitude but in determining where it is absolutely necessary for him to begin the use of oxygen to supplement the inadequate partial pressure of that in the rarefied air he breathes.

THE EYE IN AVIATION—SOME EXPERIENCES IN THE WORK OF THE DEPARTMENT OF OPHTHALMOLOGY, MEDICAL RESEARCH LABORATORY, THIRD AVIATION INSTRUCTION CENTER, A. E. F., FRANCE[1]

By Major CONRAD BERENS, Jr.
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While speaking of the work in the Department of Ophthalmology, it might be well to mention some of the ophthalmological problems, for even when one has been actively engaged in the study of aviation medicine it is impossible to keep fully informed. Research has been done in all the allied countries on the effects of altitude on the aviator, and the collected papers from the Medical Research Laboratory (1), Air Service, Mineola, give a résumé of the work in this country. The consensus of opinion is that the changes in the bodily functions at high altitudes are due mainly to the want of oxygen. In our experience the administration of oxygen prevented the onset of symptoms and restored the ocular functions to normal, even in the presence of lowered barometric pressure (2).

Under actual flying conditions there are some types of work in which the aviator flies at such a low altitude that the lack of oxygen becomes almost negligible. Aviators doing low altitude work often need as much rest, and break down as quickly, as photographic reconnaissance pilots flying at high altitudes.

The causes of staleness other than the lack of oxygen may be grouped under the term "Flying Stress," and the low altitude work practiced more universally in the last few months of the war was particularly trying. It consisted in "shooting up" trenches, marching columns, and even soldiers in rest billets; work was usually carried out under 500 feet, where an accident or a hit meant almost certain death to the aviator, as there was seldom sufficient altitude in which to right the plane. Low altitude trips in the absence of hostile aircraft are not so fatiguing, as the only strain is that of nerve tension due to watchful waiting.

That a normal eye is of importance to the chasse pilot is appreciated by him, and 80 per cent of the fliers questioned at Issoudun gave the eye as the most valuable asset of the successful pilot. That this may be true can be readily understood when we realize that in addition to keeping his eye on the enemy he must keep his line of flight, orient him-

[1] Read at the Fourth Annual Meeting of the Air Service Medical Association of the United States St. Louis, Mo., May 23, 1922.

self in relation to underlying objects, read maps, select proper landing places, make landings, operate his machine gun and watch over every detail of the plane and motor. The mere task of looking for the enemy as described for me by Lieutenant Snook would be enough for the ordinary man to do. In his words:

The safety and the proper execution of the work of a chasse pilot depend entirely upon his vision. As one approaches the lines he immediately tries to locate, in his mind, all machines and patrols in his sector. The most effective means of accomplishing this is by dividing the sky into four divisions: (1) Left side, above superior wing; (2) left side, beneath inferior wing; (3) right side, above superior wing; (4) right side below inferior wing. The clearing of these areas is best accomplished by gazing, without attempting to focus on any definite point. If a machine is located it will appear as a mere speck and one must focus on it immediately. The pilot now looks: (1) above, (2) below, (3) right, and (4) left, still carrying the focus of the first machine. He bears the location of this plane in mind while clearing the other areas in the same manner. The portions of the sky covered by the wings and fuselage must be uncovered by movements of the plane. Blind spots, caused by the superior and inferior wings of the same side, are cleared by throwing the machine into a virage in the opposite direction. This lifts the wing, and one may see above and below. At this same moment, while the machine is in the virage, the pilot, by turning his head, may clear the sky behind and under his tail. He then virages in the opposite direction, thus clearing the blind spots on the other side. the chasse pilot should continue these movements during the entire patrol, allowing no blind spot to be covered over forty-five seconds.

Our feeling in this country has always been that ocular physical standards for admission to the flying corps should be kept high as long as we had a sufficient number of men to choose from, but we have realized the faults in the routine ocular examination and have made apparatus in the hope that we could go beyond the usual tests employed in selection. The fact that a man has normal eyes and 20–20 vision does not necessarily mean that he will be able to use his eyes as successfully as a man who has a few minor ocular defects. For instance, a man who has excellent vision may not see or recognize the enemy plane as soon as a man of experience, although handicapped by poor eyesight. It is a well-known fact that, during the first few flights over the lines, the new pilots see very little.

All the flight leaders we saw at Issoudun were not only supposed to have exceptional vision but actual tests showed their visual acuity to be 20–15 or 20–10. If the individual chasse pilot or flight commander can see a speck in the distance and recognize it as an enemy plane before the enemy sees him, he has a tremendous advantage. He can then choose his method of attack and take the most favorable position.

Even after the enemy plane is close at hand the ability to see clearly is not sufficient, for in maneuvering for position and in shooting a machine gun the chasse pilot must be able, quickly and accurately, to determine the direction and speed of the other plane. We have devised an apparatus for recording rapidity and accuracy in making this type of visual judgment. The present apparatus is a small plane drawn by a motor through two rings sliding one inside the other, swung in a U-shaped upright. By manipulation of the rings and motor the speed and desired direction may be imparted to the plane. The time taken to tell the direction of the plane is recorded by means of a timing screen. The apparatus may be used in connection with a camera machine gun, and accuracy recorded on the film. Other apparatus have been devised for timing orientation in map reading, determining position and color of lights and judging distance as it applies particularly to the landing problem.

We believe that normal uncorrected vision is less important than normal muscle strength and balance and the ability of the muscles to withstand strain. We do not, however, agree with Parsons' (3) statement that a 2–20 or 10–20 difference in visual acuity will not decide the fate of the ambitious aviation student. That the extrinsic and intrinsic ocular muscles fatigue quickly when deprived of oxygen has been demonstrated in the decompression chamber and the Henderson rebreathing apparatus. The administration of oxygen prevents the onset of fatigue to a great extent and, after it has occurred, relieves it, even in the presence of lowered atmospheric pressure. The loss in efficiency of the ocular muscles is annoying and often dangerous to the safety of the pilot in the presence of high hypermetropia, hypermetropic astigmatism or convergence insufficiency, particularly when combined with divergence excess. The weakening effect upon the muscles of being at a high altitude for several hours results, in the case of refractive errors, in loss of visual acuity and, where the extrinsic muscles were weak, in difficulty in judging distance and in landing. Laboratory altitude tests have demonstrated recession of the near point of accommodation and convergence and weakening of the power of adduction at high altitudes; these changes were particularly noticeable in men who had been ocularly disqualified as pilots by the admission tests.

The Germans have stated, notably Halben (4), that color vision was only of importance when colored lights were to be considered. They took in men with defective color vision because approximately 3 per cent of men are color blind and they needed pilots; they also eliminated colored lights whenever possible. The allied countries have insisted upon normal color vision in so far as red and green were concerned. We

believe that normal color vision is of importance in differentiating signal lights on planes and dromes, in distinguishing colors of uniforms, in shooting, and in the more careful selection of landing places.

The value of the eye in maintaining equilibrium has been the subject of considerable discussion [Knapp (5), Lewis (6), Freidenberg (7)], and our conclusion is that the eye is the most important factor in this complicated problem. Even with the eyes open an aviator with normal labyrinths will sometimes emerge from a cloud in a wing slip unless he watches his laterometer and inclinometer. We believe that observing instruments and knowing how to fly by them is most important.

Eye Work in the Field.—Although as much research was done as circumstances permitted, the bulk of the work was in putting into practice the information gained in the Research Laboratory at Mineola.

The research work comprised studying the effect of altitude, by laboratory means and by actual flights, improving and testing goggles, determining the effect of common drugs, tobacco and alcohol, upon the ocular functions and devising apparatus.

The activities of the Ophthalmological Department, in caring for the flier, may be divided into selection, classification and maintenance.

In selection, the usual 609 examination form was used with the addition of the fogging test for the detection of manifest hypermetropia and the recording of the near point of convergence. We believed practical experience has shown and research proven the correctness of our views when we stated that "a low degree of myopia carefully corrected was less dangerous than uncorrected hypermetropia." Several myopic pilots have stated that they could see better in the air than their hypermetropic observer, although their corrected vision was not quite as good as that of the observer. We know that the effect of insufficient oxygenation of the ciliary muscles, with resulting relaxation of accommodation, would account for this fact.

In ocularly classifying pilots as to the altitudes at which they may fly, we relied more upon thorough examination of the eye than on the rebreathing or decompression chamber test. We felt justified in only making the rebreathing test in exceptional cases, for our Mineola experience had taught us that we could usually designate the pilots who would show an ocular break. If no functional weakness was shown upon examination, the eye weakness was always secondary to the physiologic or psychologic break and the pilot was properly classified by these departments.

The ideal method of maintaining the pilot's ocular efficiency would be to examine the eyes of each pilot once a month, but we were only

able to care for men who were complaining. Examinations were made of 794 men who had been having difficulty in making landings, had crashed, were considered stale, or were referred to us upon discharge from the hospital before they were permitted "on the flying list." The total number of examinations, reexaminations and treatments was 1,074. Special examinations were made of 70 monitors, 8 testers, 112 fliers from the American front, 12 French fliers and 21 American Aces (8).

The results of these examinations are outlined in a table in which 21 American aces appear twice—in a group by themselves and again in the group of fliers from the American front. Although 58 per cent of the French fliers examined were night bombers, the results show that their eyes were well above the average. The table shows that the American ace was not ocularly supernormal compared with the French pilots or with the other American fliers. But it does show that his ocular standard was in accord with his other high attributes.

Vision.—These men, with 442 enemy planes to their credit, had excellent uncorrected vision. In 118 cases (53.15 per cent) the vision in the right eye was 20–15 or better. In 120 cases (54.05 per cent) the vision in the left eye was 20–15 or better. Only 2.7 per cent of the number wore correction in their goggles, and those who needed correcting lenses were myopic and corrected to 20–15 or better.

Color Vision.—Every one of the men examined had normal color vision. One hundred and twenty-four had flown at the front and the other 78 had been selected as instructors or testers. Ninety-one and seven-tenths per cent of the men, questioned about normal color vision, declared that it was most necessary; 8.3 per cent considered the matter unimportant, but they themselves passed Jenning's test without an error.

Accommodation.—According to the present requirements for entrance into our Air Service, a near point of accommodation greater than 110 mm. from the cornea at 20 years of age, greater than 130 mm. at 25 years, or greater than 150 mm. at 30 years, disqualifies. Of the men examined, the average near point of accommodation at 20 years of age in this table is 81.67 mm., high 90 mm., low 65 mm.; at 25 years, average 104.68 mm., high 140 mm., low 80 mm.; at 30 years, average 108 mm., high 120 mm., low 100 mm. These figures show that the present requirements give sufficient latitude in selection. Although no allowance is made for the hypermetropia (which averaged +0.57 D in the total number of examinations), these measurements correspond closely with Donder's figures as amended by Duane.

Extrinsic Ocular Muscles.—The duction power of the ocular muscles

at 6 meters and at 25 cm. should be part of the record. For practical reasons, the adduction should be tested last. In this table, at 6 meters, the average prism divergence is 5.82^{Δ} and prism convergence 14.1^{Δ}, At 25 cm. the same tests give correspondingly 16.47^{Δ} and 38^{Δ}. Therefore, it seems that the converging power should never be less than double the diverging power at all distances.

Near Point of Convergence.—The average near point of convergence measured from the cornea of those men whose ages averaged 26.64 years is 47.17 mm. The highest average figure of 66.67 mm. happens to correspond to the average of 31 years of age, though four of the men were 32 and two were 35 years old. It would seem wise, therefore, to consider a near point of convergence of over 80 mm. a cause for disqualification.

The Master Eye.—To determine whether the master eye gives an indication as to which side the pilot looks in landing, 12 aviators were examined. All the pilots were right-handed, the right eye was the master eye in 72.72 per cent, and yet 58.1 per cent looked to the left on landing and only 24.9 per cent looked to the right. Eight and five-tenths per cent looked ahead and 8.5 per cent either side indiscriminately. The fact that the pilot was right or left handed or that the right or left eye was the master did not give any indication of the side to which he would look in landing.

Stereoscopic Vision.—All the men examined had normal stereoscopic vision, and most of them made their judgments quickly and accurately. This fact is strongly suggestive of the value of normal stereoscopic vision for the successful pilot.

Many of the fliers showed weakness of the converging power, and Howe's modified ergograph proved very useful in diagnosing and training pilots with muscle weakness.

A pilot and observer were tested before and after a flight to 16,000 feet, one day using oxygen and another without it. Although statements as to how they felt varied, the examination after the flight, during which oxygen was used, showed less fatigue of the ocular muscles. The findings were significant, for they had only been at 16,000 feet one hour.

CONCLUSIONS

1. Up to 10,000 feet ocular changes noted are not constant, occasionally apparent improvement is noted, but in averaging the examinations of a number of men there was usually little change. Beginning weakness of the ocular functions is usually noted between 10,000 and 15,000 feet, and changes are nearly always more marked at 20,000 feet and over.

2. From our findings we believe that at lower altitudes the ocular functions may possibly be stimulated for a brief time, but at higher altitudes weakness results. The apparent improvement, occasionally noted at low altitudes, may be partly due to the difficulty in obtaining the maximum effort in the preliminary examinations. The factor of excitement in the first few minutes of a new experience may bring forth greater muscular effort, but we doubt that the early changes are due to oxygen want. At increasing altitudes, depending upon the individual, the eye ceases to function. This is secondary to cerebral or circulatory disturbances, unless a gross refractive error or muscular defect is present.

3. The administration of oxygen prevents the onset of changes due to altitude *per se* and quickly restores ocular functions to normal, even in the presence of lowered atmospheric pressure.

4. The results obtained on the rebreathing apparatus and in the low pressure chamber are, for practical purposes, the same and the experimental findings receive confirmation in actual flying.

5. Ocular physical standard for pilots should be high as long as there are a sufficient number of men to select from, but findings should be carefully considered in connection with mental and physical qualifications.

6. Altitude experimentally produced, lessens the sensitivity of the eye and weakens the ocular muscles. It would seem, therefore, that the following ocular standards for the aviator were necessary: Uncorrected vision of 20–20 in each eye and not more than two dioptries of manifest hypermetropia. Normal muscle balance for distance and near with good converging and diverging power. Normal power of accommodation. Normal sensitivity to colors and light with rapid adaptation, quick visual reaction time and rapid accurate stereopsis.

SELECTED BIBLIOGRAPHY

(1) Manual of Medical Research Laboratory. War Department—Air Service Division of Military Aeronautics, Washington, D. C.

(2) Effect of Altitude on Ocular Functions. J. A. M. A., 1918, 71: 1394.

(3) Parsons, R. P.: A Search for Non-Physical Standards for Naval Aviators. Govt. Printing Office, 41088 a-18, Washington, 1918.

(4) Halben—Die Augen der Luft fahren. Jahrbuch der Wissenschaftlichen Gesellschaft fur Flugtechnik. Berlin, 1914, II, 158–168.

(5) Knapp, A.: Equilibrium and Orientation, rôle of eyes in Am. Jour. Otol. Rhinol. and Laryngol., 1916, 25: 453.

(6) Lewis, E. R.: Visual Factors in Equilibration, Especially Aviation. J. A. M. A., 1918, v. 70, p. 1626.

(7) Friendenberg, P.: Visual Factors in Equilibration, Especially Aviation. J. A. M. A., 1918, v. 70, p. 991.

(8) Wilmer, W. H., and Berens, C., Jr.: The Eye in Aviation. Aviation Medicine in the A. E. F. War Department, Washington Documents No. 1004, pp. 183–184.

COMPLETE BIBLIOGRAPHY[2]

Aviation—Altitude and Allied Subjects

(a)—altitude. (e)—eye. (av)—aviation

(a) Acosta, José d': Historia Natural y moral de las Indias, Lib. 3, chap. 9, Seville, 1590.

(av) Aggazzotti, A.: I limiti di idoneita nell' esame della emozionabilita. Gior. d. med. mil., lxvii, 218–223, Roma, 1919.

(av) Aggazzotti, A.: Influenza del vento sulla funzione respiratoria e sul polso. Gior. di med. mil., lxvii, 107–132, Roma, 1919.

(av) Aggazzotti, A.: Relazione sul lavoro compiuto nell' Ufficio psicofisiologico di aviazione militare di Roma dal 27 Aprile al 15 Dic. 1918. Gior. d med. mil., lxvii, 8–13, 1919.

(av) Aggazzotti, A.: Sul riflesso cardio-vasco-lare agli stimoli sensorialiemotivi. Gior. di med. mil., lxvii, 89–107, Roma, 1919.

(av) Anderson, H. G.: Selection of candidates for Air Service. Lancet, 1:395, March 16, 1918.

(av) Anderson, H. G.: Medical Aspects of Aeroplane Accidents. Brit. Med. J., 1:73, January 19, 1918.

(av) Anderson, H. G.: Aviators' Sickness. Riforma Med., 34:333, April 27, 1918. Ab. 71:155, July 13, 1918.

(e) (av) Azzi, A.: Sulla determinazione dei tempi di reazione discriminativa. Gior. di med. mil., lxvii, 210–212, Roma, 1919.

(av) Babcock, H. L.: Aviation Bárány Tests as Applied to Aviators, Some Observations on. Boston M. & S. J., 177:840, December 13, 1917.

(av) Bachman, R. A.: The Examination of Aviators. U. S. Navy M. Bull., 12:30, January, 1918.

(av) Belli, C. M.: Requisiti fisici e prichici per il servizio di pilota aereo nella R. Marina ann. di med., ii, 352–362, Roma, November, 1914.

(e) Berger, E.: Vision, Psychology and Physiology of, Research on, Cor. Bl. f. schweiz. Aerzte 47:892, July 14, 1917.

(e) (a) Bert, Paul: La Pression barometrique. Paris, 1878.

(e) (av) Bilancioni, G.: Osservazioni sull' esame vestibolare dei candidati all' aviazione e dei piloti, specialmente in riguardo al nistagmo. Gior. di med. mil., lxvii, 164–175, Roma, 1919.

(av) Bilancioni, G.: Concetto della resistenza e della debolezza respiratoria. Gior. di med. mil., lxvii, 132–135, Roma, 1919.

(av) Bilancioni, G., and Romagna-Manoia, A.: Ricerche sullo stato della coscenza nella vertigine rotatoria. Gior. di med. mil., lxvii, 175–180, Roma, 1919.

(av) Binet, L.: Le mal des aviateurs et la silection des pilotes militaires. Rev. gen. d. sc pures et applig. Paris, 1917, xxviii, 540–545.

(av) Blaauw, E.: Visual Requirements of Military Aviators. J. A. M. A., 68:1205, Chicago, 1917. Also Opth. Record, 26:323, 1917.

(a) Bowles, B.: Uber den Einfluss der Sonnenstrahlen auf die Haut. Monatshefte für praktische Dermatologie, N. 1., xviii.

(av) Boyer, J.: Selecting Aviators. Psycho-Motive Examination of Candidates for French Service. Science American, N. Y., 115:6, 1916.

(a) Boyle, Robert: The works of the Hon. Robert Boyle. Trans. by Richard Boulton. Vol. II, London, 1700. Made a compression and decompression chamber for animals, 1677.

---

[2] Compiled with the assistance of Mr. C. R. Sage, Surgeon General's Library, Washington, D. C.

(a) Boyle, Robert: Tractatus Nova Experimenta a pneumatica Respirationem spectantia. Title xi, Experim. 5, p. 238–240. London, 1672. Experimentum Digressiun Circa Respirationem in perquam Excelsis Montanibus.
(av) Bozzi, F.: Contributo Alla fisiologia dell' Aviazione. Gior. di med. mil., 65:653–656, 1917.
(av) Bunard, A.: Medical Studies in Aviation. Progrès Méd. 33:166, May 11, 1918. Ab. 71:154, July 13, 1918.
(a) Bürker, K.: Die physiologischen Wirkungen des Höhenklimas, Archiv. für die gesammte physiologie, 105:480, Bonn, 1904.
(av) Buthier, D.: Cardio-Vascular Observations. Bull. Acad. de Med., par. 80:232, September 10, 1918.
(av) Camis, M.: Un Mezzo per guidicare il grado di sensibilità agli stimoli amozionali. Gior. di med. mil., lxvii, 188–196, Roma, 1919.
(e) Campbell, K.: Heterophoria, with special reference to flying. Med. Press, n.s., cvii, 25–27, London, 1919.
(av) Camus, J., and Nepper: Temps des reactions psycho-motrices des candidats a l' aviation. Compt. rend. Acad. d sc., Par. 163:106, 1916.
(av) Castex, A.: Ear Disturbances in Aviation. Bull. acad. de Med. Par., 79:458, June 25, 1918.
(av) Castex, A.: Troubles Auriculaires Chez les Aviateurs Militaires, Rev. gén. de clin, et de thérap., Par. 31:36–38, 1917.
(av) Chamberlain, W. B.: Aviation Corps, Medical Examination of. Cleveland M. J., 16:545, August, 1917.
(a) Clanny, W. Reid: The Lancet, Vol. I, 804, March 7, 1835 (see description of Compression and Decompression Chambers devised by him).
Cobb: Eye Function and Light. Cleveland M. J., 15:164, March, 1916.
(a) Conheim, Otto: Die wirkung der Höhenklimas auf den Menchen. Medizinische Klinik 1:783, May 18, 1913.
(av) Conlin, F. M.: Physical Examination of Applicants for Aviation Service, U. S. Army. Nebraska M. J., 3:120, April, 1918.
(av) Connor, C. H.: Physical Examination of Aviators for U. S. Army. Military Surgeon, 40: 29, January, 1917.
(av) Cottle: Aviation, Personnel, Naval. Military Surgeon, 39:353, October, 1916.
(av) Craig, R. H.: Static Labyrinth and Ear Test for Aviators. Canada M. Assn. J., 8:199, March, 1918.
(e) (av) Culbertson, L. R.: What Is Cause of Defective Orientation or Equilibration in Aviation? Ann. Otol. Rhin. and Laryn., 27:187, March, 1918.
(av) De Witt, L. M.: Aviation from Medical Point of View. Internat. A. M. Museums Bull. No. 7:197, May, 1918.
(av) Di Nola, A.: Organizzaione sanitari dell' aviazione. Gior. di med. mil., lxvii, 26–30, 1919.
(av) Dunlap, K.: Aviation, Psychologic Observations and Methods. J. A. M. A., 71:1392, October 26, 1918.
(e) (av) Eldridge–Green, F. W.: Binocular Vision. Ophthalmoscope, v. 14, p. 315, 1916.
(av) Étienne, G., and Lamy, G.: L'hypertrophia du coeur chez les aviateurs. Arch. d. mal. du coeur Par., xi, 510–519, 1918.
(av) Étienne, G., and Lamy, G.: Le coeur des aviateurs, pathogénie et conséquences. Paris Méd., xxix, 293–296, 1918.
(av) Étienne, G., and Lamy, G.: Heart in Aviation. Paris, Med., 8:293, October 19, 1918, and Bull. Acad. de Med. Par., 80:151, August 6, 1918.

(e) (av) Fagin, R.: Ocular Requirements for Aviators. J. Tenn. M. A., 11:177, September, 1918.
(e) (av) Ferree, C. E., and Rand, G.: Inertia of Adjustment of Eye for Clear Seeing at Different Distances: A study of ocular functions with special reference to aviation. Am. J. Ophth., 1:764, November, 1918.
(av) Fiolle, J.: L'avion Sanitaire. Presse Med. Par., 25 (Suppl.), 721–723, 1917.
(av) Fisher, L., and Lyman, H.: Ear in "Stunt" Flying. J. A. M. A., 71:1977, December 14, 1918.
(av) Fisher, L.: The Practical Value of Ear Studies. Med. Rec., N. Y., xcv, 210, 1919.
Frangenheim: Uber die Verletsungen vom Fliegeruberfall. Munchen Med. Wochnschr, 65:1091, 1918.
(e) (av) Friedenberg, P.: Visual Factors in Equilibration, Especially Aviation. J. A. M. A., 70:991, April 6, 1918.
(av) Galeotti, G.: L'ergoestesiografo: un apparecchio per investigare le attitudini musculari dei candidati all' aviazione. Gior. di med. mil., lxvii, 143–147, Roma, 1919.
(av) Galeotti, G., and Cacciapuoti, G. B.: Un metodo di misura della capacita attentive applicato alla scelta dei candidati all' aviazione. Gior. d. med. mil., lxvii, 207–209, Roma, 1919.
(av) Galeotti, G.: Relazione sul lavoro compiuto nell' Ufficio psico fisiologico di aviazione della R. Marian di Napoli dal 20 genn. al 30 dic. 1918. Gior. di med. mil., lxvii, 14–16, 1919.
(av) Galeotti, G.: Su di un metodo per determinare la velocita di appercezione. Gior. d. med. mil., lxvii, 202–207, Roma, 1919.
(av) Galeotti, G.: Ergoestesiograph. An apparatus for graphical representation of muscular aptitude of candidates for aviation. Lancet, 2:702, November 23, 1918.
(av) Galeotti, G.: Pressione sanguigna ed aviazione. Gior. di med. mil., lxvii, 72–78, Roma, 1919.
(av) Gemelli, A.: Riassunto di alcune indagini sulla psicofisiologia degli aviatori compiute nel laboratorio di psico-fisiologia del Comando supremo. Gior. di med. mil., lxvii, 49–71, Roma, 1919.
(av) Gemelli, A.: Sulla Composizione del sangue degli Aviatori. Bull. d. 1st. sieroterap. Milanese, 1:105–110, 1917.
(av) Gemelli, A.: Sull' applicazione dei metodi psicofisici All' esame dei candidati all' Aviazione Militaire. Riv. di. psicol. Bologna, 13:157–190, 1917.
(av) Gilchrist, N. S.: Causes of Breakdown in Flying. N. Y. M. J., 108:906, 1918.
(av) Gilchrist, N. S.: An Analysis of Causes of Breakdown in Flying, with note on the nervous mechanism of the flying man. Brit. M. J., 2:401-403, London, 1918.
(a) Glaisher, James: Notes of Effects Experienced during Recent Balloon Ascents. The Lancet, II:559, 1862.
(av) Gradenigo: Ricerche psicofisiologiche sui candidati al pilofaggio d'Aviazione Militare, Gior. di med. mil., 66:307, Roma, 1918.
(av) Gradenigo, G.: Funziono tubaria ed aviazione. Gior. di med. mil., lxvii, 137–142, Roma, 1919.
(av) Gradenigo, G., and Gemelli, A.: I reattivi psicologicai per la scelta del personale militare navigante nell' aria. Riv. di psicol. Bologna, xiv, 145–166, 1918.
(av) Gradenigo, G., and Gemelli, A.: I testi per la scelta del personale militare navigante dell' aria. Gior. di med. mil., lxvii, 31–48, 1919.
(av) Gradenigo, G.: Gli uffici psico-fisiologici per l'esame del personale di aeronautica in Italia. Gior. di med. mil., lxvii, 3–6, 1919.

(av) Gradenigo, G.: I problemi sanitari della aviazione. Riforma med., xxxv, 8, Napoli, 1919.

(av) Greene, R. N.: Aviation. Aero Medical Observations. MILITARY SURGEON, 41:589, November, 1917.

(av) Guggenheim, L. K.: Aviation and Otology. Interstate M. J., 24:865, September, 1917.

(e) (av) Guillani, G.: Syndrome de Claude Bernard Horner consecutif a une chute d' Avion. Bull. et Mén. Soc. Méd. d. hôp de Par., 3s, 42:761, 1918.

(av) Hahn, R.: L'esame della vertigine galvanica nei piloti e nei condidati al pilotaggio Confronto dei valori ottenuti con quelli ricavati dalle prove rotatorie. Gior. di med. mil., lxvii, 154–158, 1919.

(e) (av) Halben: Die Augen der Luftfahren. Jahrbuch der Wissenschaftlichen Gesellschaft fur Flugtechnik, Berlin, ii, 158–168, 1914.

(e) (av) Halben: Die Indikation Zur Monokelverordnung Therapeutische monatshefte, 27, 1913.

(av) Hamilton, A.: Aeroplane, Industrial Poisoning in Manufacture of. T. A. M. A., 69:2037, December 15, 1917.

(a) Hammer: Einfluss des Lichtes auf die Haut. Stuttgart, 1891.

(av) Hastings, H.: Reactions of Normal Labyrinth, Experience in U. S. Aviation Examinations. Ann. Otol. Rhin. and Laryn., 27:481, June, 1918.

(av) Henderson, Y., and others: Medical Studies in Aviation. J. A. M. A., 71:1382, October 26, 1918.

(e) (av) Herlitzka, A.: Sulla determinazione del tempo di riconoscimento di un segno. Gior. d. med. mil., lxvii, 196–201, Roma, 1919.

Herrenschwand, von: Zwei weitere Fälle von Schädigung der Hornhaut im Hochgebirgskriege durch Kälteeinwirkung. Weiner Klin. Wchnschr,, Vol. 31, No. 16–456, April 18, 1918.

(a) Herrera, A. L.: La Vie Sur les Hauts Plateaux. Mexico, 1899.

Hillemanns, M.: Ueber Lichtsinnprufung für militärische Zwecke. Klin. Monatsbl. f. Augenh., lxi, 456, October, 1918.

(av) Hirschlaff, W.: Gibt es eine Fliegerkrankheit. Berliner Klinische Wochenschrift, lv, 350–353, 1918.

(a) Hoffman, J. W.: Ueber die Schneblindheit, Mittheil, deutsch. u. Oester. Alpenvereine, N. 6, p. 64, 1886.

(e) (av) Holloway, T. B.: Aviators Dazzling. Tr. Coll. Phys. Phila., 3s, 38:380, 1916.

(e) (av) (Italian): Ricerche biologiche sull' Aviazione. Negli uffici psico-fisiologici italiani dell' aviazione Militare. Tipografia Nazionale Bertero, via nonbria, 27, Roma, 1919.

(av) Johnston, J. I.: The Cardio-Vascular Problem in the Aviation Recruit. Penn. M. J., 22:53–55, November, 1918–19.

(av) Jones, I. H.: Aviation and Ear. J. A. M. A., 69:1607, November 10, 1917.

(av) Josué, O.: L'examen die coeur et des vaisseaux chez les aviateurs. Arch. de méd. et. pharn. Mil. Par., 69:609–628, 1918.

(a) Junod, V. T.: Recherches physiologiques et thérapeutiques sur les effets de la compression et de la raréfaction de l'air, tant sur le corps que sur les membres isolés. Extrait d'un mémorire lu a L'Académie des sciences, le 25 Août 1834. Revue Médicale Francaise et Étrangère 3:350, September, 1834.

Kamionsky, S.: Der Verminderte Luftdruck. Als Ursache von schweren Erkrankungen. Inaugural-Dissertation, Zürich, 1907. (Repr. of Thesis, Library, S. G. O.)

(a) Kern, Berthold: Ueber den physiologischen Einfluss der Elevation. Berlin, December 23, 1872. (Repr. of Thesis, Library, S. G. O.)

(av) Kerrison: Examination of Army Aviators. Am. Otol., Rhinol. and Laryngol. St. Louis, 27:1077, 1918.

(a) Kessner, F.: Ueber die physiologische Wirkung des verminderten Luftdrucks im Hohenklima. Berlin, March 5, 1887. (Repr. of Thesis, Library, S. G. O.)

(e) (av) Knapp, A.: Equilibrium and Orientation, Rôle of Eyes in. Am. Otol., Rhinol. and Laryngol., 25:453, June, 1916.

(av) Knott, J.: Aviator's Sickness. Med. Press. and Circ., London, ci.:519, 1916.

Koschel, E.: Welche Anforderungen Mussen an die Gesundheit der führer von Luftfahrzeugen gestellt werden? II Band 1913–14, 2 Leeferung, p. 143, Verlag von Julius Springer, 1914.

(av) Lacroix, P.: Aviation, Ear Reactions in. Bull. Acad. de Med., par. 47–94, January 16, 1917.

(av) Lane, W. A., Sutherland, G. A., and Joynson-Hicks, W.: The Medical Service of the R. A. F., Principles of Promotion. Lancet, London, 2:679, 1918.

(av) Lascelles, J. E.: Accidents, Loss of Head in Aeroplane Accidents. Brit. Med. J., 1:535, May 11, 1918.

(av) Lee, C. F.: Aviation and the War. J. Wash. Acad. Sc., Balt., 8:255, 1918.

(e) (av) Lemer, H. B.: Oculomotor Reaction to Labyrinth Stimulation. Tr. Sect, Laryn., Otol. and Rhin. A. M. A., p. 156, 1918.

(a) Lescha, J.: Beobachtungen and Versuche zur Anwendung comprimirter und verdünnter Athmungsluft. Bonn, 1884. (Repr. of Thesis, Library, S. G. O.)

(a) Levy, J. S.: Uber den Einfluss der verdünnten Luft. Berlin, February 15, 1882. (Repr. of Thesis, Library, S. G. O.)

(av) Lewis, E. R.: The Field of the Medical Research Laboratory at Mineola. Med. Rec., N. Y., xcv, 210, 1919.

(av) Lewis, E. R.: Otologic Problems from the Standpoint of Aviation Service. Jr. Am. Otol. Soc., 3:499–451, 1918.

(av) Lewis, E. R.: Influence of Altitudes on Hearing and Motion Sensing Apparatus of Ear. J. A. M. A., 71:1398, October 26, 1918.

(e) (av) Lewis, E. R.: Visual Factors in Equilibration, especially Aviation. (Repr. J. A. M. A., 70:1626, June 1, 1918.)

(a) Loewy, A., and Zuntz, L.: Uber den einfluss der verdünnten. Luft und des Höhenklimas auf den Menchen Archiv für die gesammte Physiologie, 660:477 Bonn, 1897.

(a) Lortet, von: Perturbations de la respiration, de la circulation et surtout de la calorification à de grades hauteurs, sur le Mont. Blanc. Comptes rendus. Des séances de L'Académie des sciences, page 707, September 20, 1869.

(av) Lyman, H. W.: The Ear and the Aviator. Med. Rec. N. Y., xcv, 211, 1919.

(av) Lyster, T. C.: Aviation Medical Service Here and Abroad. Jr. Am. Otol. Soc., 3:452–456, 1918.

(av) Lyster, T. C.: Aviation Service of Medical Dept. of Army. Ann. Otol., Rhin. and Laryn., 27:851, September, 1918.

(av) McWalter, T. C.: The Sense of Projection in Flying Officers. Brit. M. J., London, 2:672, 1917.

(av) Malan, A.: La prova dell' indicazione come viene praticata nell' esame dei candidati all' aviazione. Gior. di med. mil., lxvii, 147–153, 1919.

(av) Malan, A.: Dell' esame del senso statico della posizione e del senso della verticalità nei candidati all aviazione. Gior. di med. mil., Roma, lxvii, 159–163.

(av) Manginelli, L.: Variazioni della pressione sanguigna in aeroplano: esperienze in volo. Gior. di med. mil., lxvii, 78–89, Roma, 1919.

(av) Manuel, E. G.: Strain and Stress of Flying. Lancet, 2:415, September 28, 1918.
(a) Mosso, A.: Life of Man on the High Alps. Translated from second edition of the Italian Book, by E. Lough Kiesow. (London, 1898, T. Fisher Unwin.)
(a) Murray, J.: Nature and Treatment of Cholera. New method proposed. London Med. and Surg. Jour., 1:749, July 14, 1832.
(a) Murray, J.: Observations on the Medical and Surgical Agency of the Air Pump. Dublin, 1836. (Library, S. G. O.)
(av) Murry, W. R.: Vestibular Apparatus in Relation to Aviation. Lancet, 38:155, March 15, 1918.
(av) N. Y. Med. Jour. (Editorial): The Flight Surgeon and the Flying Ambulance. N. Y. M. J., cix, 244, 1919.
(e) O'Conner, R.: The Relation of the Eyes to Rifle Shooting. Ophthalmology, 11:745, July, 1915.
(e) Oloff: Ueber Farbensinnuntersuchungen in der Deutschen Marine. Klin. Monatsbl. f. Augenheilk, 61:337, Aug.-Sept., 1918.
(av) Parsons, R. P.: Search for Non-Physical Standard for Naval Aviators. U. S. Nav. M. Bull., 12:155, April, 1918 (Repr.).
(av) Parsons, R. P. and Segar, L. H.: Bárány Chair Tests and Flying Ability. Correlation Study of 100 Naval Aviators. J. A. M. A., 70:1064, April 13, 1918.
(av) Paton, S.: Effects of Low Oxygen Pressure on Personality of Aviator. J. A. M. A., 71:1399, October 26, 1918.
(av) Paton, S. MacLake, W., and Hamilton, A. S.: Personality Studies and Personal Equation of Aviator. Mental Hygiene, 2:629, October, 1918.
Payerne, M.: Observations tendant à démontrer que, dans les Ascensions sur les hautes montagnes, la lassitude et l'anhéltation éprouvees par la plupart des explorateurs n'ont pas pour cause une insuffisance d'oxygene dans L'Air respiré. Comptes Rendus des séances de L'Académie des sciences, 33:198, 1851.
(av) Rippon, T. S., and Manuel, E. G.: Essential Characteristics of Successful and Unsuccessful Aviators with Reference to Temperament. Lancet, 2:411, September, 28, 1918.
(av) Robertson, C. M.: A New Test and Method of Classification for Labyrinth, Muscle Tone and Blood Pressure Findings in Men Entering Military Aviation Service. Jr. Am. Otol. Soc., 3:457-486, 1918.
(av) Robertson, C. M.: Examination of Men Entering Aviation Services, New test and method of classification for labyrinth, muscle tone and blood pressure findings, preliminary report. J. A. M. A., 71:813, September 7, 1918.
Roemisch, W.: Die Wirkung des Hochgebirgs—Klimas auf den Organismus des Menschen Essen 1901. (Repr. Library S. G. O., box 690.)
(av) Romagna, Manola, A.: Osservazioni sul tempo di reszione composita. Gior. di med. mil., lxvii, 212-217, Roma, 1919.
(av) Romagna, Manola, A.: L'esame neurologico nei candidati all' aviazione. Gior. di med. mil., lxvii, 136, Roma, 1919.
(av) Saffiotti, F. U.: Brevi note preventive siu risultati di alcune ricerche psicometriche sui candidati all' aviazione e sui pilote. Gior. di med. mil., lxvii, 180-188, Roma, 1919.
(av) Schneider, E. C.: Aviation, physiologic observations and methods. J. A. M. A., 71:1384, October 26, 1918.
(e) (av) Schroetter, H. von: Hygiene der Aeronautik und Aviatik. Wein und Leipzig. (Wilhelm Branmüller.), 1912.

(av) Schöppler, H.: Uber den Fliegertod. Deutsche Mil. Aerztl. Ztschr. Berl., 44:265-270, 1915.

(av) Schurmeier, H. L.: Physical Effects of Flying. J. A. M. A., 69:584, August 18, 1917.

(av) Scruton, W. A.: Observations of Past-Pointing after Rotation. Ann. Otol. Rhin. and Laryngol., 27-528, June, 1918.

(av) Seibert, E. G.: Effects of High Altitudes on Efficiency of Aviators. MIL. SURGEON, 42:145, Feb., 1918.

(av) Seibert, E. G., and Henderson, Y.: Organization and Objects of Medical Research Board, Air Service, U. S. Army. J. A. M. A., 71:1382, October 26, 1918.

(e) (av) Small, C. P.: Visual Requirements of Military Aviators. J. A. M. A., 68:841, March 17, 1917.

(av) Small, C. P.: Aviation, Equilibrium Tests for Recruits, J. A. M. A., 69:1078, September 29, 1917.

(av) Stivers, C. G.: Testing the Aviation Candidate. South Calif. Pract., Los Angeles, 32:169-172, 1917.

(av) Sutherland, G. A.: Examination of Aviation Candidates. Lancet, 2:803, December 14, 1918.

(av) Tanturri, D.: Sull' ilgiene delle vie superiori del Respiro e dell' Orecchio Nell' Aviatore (Hygiene of Respiratory tract and Ear of Aviator). Riforma med., 34:574, July 20, 1918.

(av) Tanturri, D.: Organ of Hearing in Aviators. Gazz. d. Osp., 39, 55, January 20, 1918.

(av) Terry, G.: Aviation Sickness. Arch. de mal. du coeur, 10:275, June, 1917.

(av) U. S. Navy dys: Naval Cons. Board Problems of Aeroplane imp. N. Y., 32, p. 8, Bull. No. 3, 1918.

(av) Vorbe and Rocher, L.: Oste' ome des Aviateurs. J. de Med. de Bordeaux, 44:174, 1916.

(av) Wells and Anderson: Aeroplane Bombs, Injuries and Destructive Effects of. Suggested precautions to be taken during hostile air raids. Brit. M. J., 2:252, August 19, 1916.

(av) Wells, H. V.: Some Aeroplane Injuries and Diseases, with notes on the Aviation Service. J. Roy. Nav. M. Serv., London, 2:65-71, 1916.

(av) Wells, H. V.: The Flying Service, from a Medical Point of View. J. Roy. Nav. M. Serv., 1:55-60, 1915.

(av) Whitney, J. L.: Cardiovascular Observations. J. A. M. A., 71:1339, October 26, 1918.

(e) (av) Wilmer, W. H.: Ocular Conditions Affecting Efficiency of Aviator. Arch. Ophth., 47:439, September, 1918.

(e) (av) Wilmer, W. H., and Berens, C.: Effect of Altitude on Ocular Functions. J. A. M. A., 71:1394, October 26, 1918.

(av) Yearsley, M.: Aeroplane Raid, Effect of Explosives on Hearing. J. Laryngol. Rhinol. and Otol., 32:723, September, 1917.

(e) Young, G.: Threshold Tests (Schwellenproben). Brit. Jour. of Ophthalm., 11:384, July, 1918.

(e) (av) Zade: Fliegerbrillen. Klin. Monatsbl. f. Augenheilk, 61:347, Aug.-Sept., 1918.

(e) (av) Zade, M.: Aviator's Dazzling. Muench. Med. Woch., November 2, 1915.

Zuntz, N.: Höhenklima und Bergwanderungen in ihrer wirkung auf den menchen. Deutches verglashaus Bong & Co. Berlin, 1906.

(av) Zuntz, N.: Zur Physiologie und Hygiene der Luftfahrt. Luftfahrt und Wissenschaft, Heft 3, herausgegeben von Josef Sticker. Verlag von Julius Springer, Berlin, 1912.

AVIATION PROBLEMS IN THE NAVY[1]

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I AM somewhat hesitant in presenting this paper to you gentlemen, since it contains no information of medical value. However, my intention is not to advance material for discussion, but to review briefly the aviation problems which have confronted the Navy since 1911, and to make slight mention of the plans for the immediate future.

Our Navy holds the distinction of being the first to take steps to organize an Aviation Section, and, as a result, led the navies of the world in aviation activities for many months. Early in 1911, just a few months following the first successful flight of a hydroaeroplane, Congress appropriated $25,000 for aviation activities in the Navy. Three officers were ordered to airplane factories for instruction and three planes were purchased. Thus was solved the first problem.

Now that an aviation section was established, development was necessary to make of it an efficient offensive or defensive arm. Needless to say, it is efficient; efficiency had to follow solution of the many problems that arose. A few of them will be mentioned before considering the difficulties arising at sea.

The first navy fliers, realizing the necessity of launching planes from ships, experimented with a cable launching device early in 1911. That device, unsuccessful itself, was the forerunner of the present catapult which was developed in 1912. Its value is clearly manifest.

The problem of using the airplane in battle against fighting ships brought forth the torpedo plane which was patented in 1912. This type of plane was successfully used by the Germans against the British in the recent war and actually sunk one ship, which was reported.

The problem of landing on ships was taken up and a type of landing platform devised with checking devices to stop the plane within the limits of the flying-on deck or platform. Battleships now carrying planes are so equipped.

The engineers and constructors in the Aviation Section were concerned with the construction of the most efficient and durable type of plane to fit the needs of the Navy. To this end, outside facilities were used wherever possible, and the naval aircraft factory at Philadelphia was established. Much work has been done on hulls, engines, wings and other parts and materials going into the construction of

[1] Read by title at the 30th Annual Meeting of The Association of Military Surgeons of the United States, Washington, D. C., October 12–14, 1922.

navy planes until we now have what is known as a distinctly American type. Development cannot rest here, however, as the needs of the Navy continue to demand changes in design, size, power, and speed of both lighter and heavier than air craft. Nor can development rest as long as air-craft is used.

The problem of gas warfare, as it applies to aircraft, is under development at the present time; also bombs, torpedoes, and other articles of aerial warfare, not mentioned here, are being perfected.

Let us now consider aviation at sea. The ship, or aerodrome itself is mobile, therefore, when a flier goes up it is with no idea of what the location of his hangar may be when, his mission accomplished, he sets out on his return. While in contact with the enemy, visual signals and radio cannot be used for his information; his vision is of little use at night, in the presence of fog, or obscuring smoke screens and at scouting distances, and with the location of the ship not known his navigation is without objective. Thus, to the perils of the air and combat is added the menace of "being lost."

Another characteristic is that afloat there is neither launching nor landing field, the upper decks of a ship presenting anything but a plane surface. On the weather decks are stowed vegetables, boats, anchors and sundry gear; and rising to varying heights are structural necessities such as turrets, conning towers, stacks, ventilators, cranes, aerial projections such as masts, signal yards, and wireless antennae, and exposed battle stations such as anti-aircraft guns, range finders, searchlight platforms and signal bridge. These obstructions cannot be swept away, nor can they all be covered in with a platform, since then the major functions of a capital ship would be seriously impaired. It has, however, been found practicable to construct small platforms and trestles without greatly interfering with the gunnery of the ship, and the difficulties inseparable from these small areas have been met by two ingenious expedients as mentioned above, namely, the catapult and the checking device.

The catapult is designed to project planes into the air with sufficient force for them to maintain their buoyancy until their propellers can give them control. The checking device is an arrangement whereby the motion of a plane, alighting at its minimal sustaining speed, can be arrested within the limits of the flying-on deck. Embodied in this is a third device which prevents side-slip of a plane and damage to its wings by the rolling of the ship.

Some conception may be had of the demands made on a pilot's skill by such landing conditions. He must alight at the lowest possible speed, in a certain path on a ship moving through the water and per-

haps rolling and pitching, and at a point that will allow him all possible runway. The ship can rarely maneuver to head into the wind, and, to make bad matters worse, the motion of the ship and the heat currents arising combine to create an atmosphere full of "bumps." A good landing under such conditions is difficult, to say the least.

It having been found possible, by the methods described, to get planes off a ship and on board again, the problem of stowage presented itself. All openings in the deck of a ship are battened tight when action seems imminent, and hence, if planes are to be employed by a combatant ship at such time, they must be stowed on weather decks close to their launching device. There, during battle, they are exposed to certain destruction, if not from the enemy shells, then from the blasts of the ship's guns. The only thing possible is to send every plane in the air when action is near.

It was first supposed that few of the planes sent up from such ships would return. There would be no opportunity to stop to permit stray planes to land, so the planes when launched were expended unless they chanced to make a nearby carrier with an ample flying-on deck. The pilots, in order to avoid similar expenditure, were equipped with non-submersible suits so they might float until rescued by destroyers.

The most recent solution is the development of a plane with an amphibian landing gear, that is, pontoons and wheels. The regular pontoon type of plane is equipped with retractile wheels which may be let down by releasing a lever so that a landing may be made on water, land, or the deck of a ship. If a landing is made on the water, the plane can be hoisted aboard with a crane.

The type of plane most largely represented in the Navy is the so-called pursuit or combat plane. It is equipped with demountable wings for ease of stowage. In addition two other types have been evolved. The first is the spotting plane which serves the gunnery of the fleet and is used for short distance scouting, it being able to keep the air for nine hours at ninety knots. The second, conspicuously a navy type, is the seaplane corresponding to the heavy land bomber. It is adapted to long range scouting, bombing and launching of torpedoes. This plane has a cruising radius of 2,000 miles or more. It is probable that out of this type will be developed the Navy Air Ambulance. Such a plane, divested of its pontoons, is used now in Haiti and San Domingo.

I have already spoken of the interference with the handling of a ship and its gunnery, entailed by the installations necessary for the employment of planes, and have given you an idea of the impossibility of placing on an already overcrowded battleship the large personnel and

an already overcrowded battleship the large personnel and material for the maintenance of an air force. This is so true it is held that planes cannot be operated from a battleship without destroying its character, and hence that planes and guns are mutually exclusive. Although the effectiveness of an attack from the air has been demonstrated, the battleship has not been proved obsolete; therefore the problem of how best to combine the two arms on one ship. The dilemma has been met in a practical way by not attempting to combine them as co-equal, but by building ships of two distinct types in which one or the other arm is subordinated. In one type the dominant weapon is the gun; in the other, the airplane. Thus we have arrived at the airplane carrier.

Necessarily the airplane carrier is a large ship. She is about 800 feet long and has a speed of 33 knots; will carry 108 planes and 1,200 air personnel, but lacking all means of defense except her speed and her planes. Such a ship becomes an effective unit of a fleet for either offense or defense.

As indicative of the trend in naval practice, I will briefly mention what is now under way or definitely projected. Every capital ship will carry four or more planes; every cruiser one to four; every destroyer, one; every other ship of size, except colliers and hospital ships, will carry at least one. And from points in our outlying possessions, squadrons of planes, either alone or in conjunction with submarines, may be detailed to operate defensively. Balloons and dirigibles, too, will be used extensively in connection with the air forces.

From this paper you can get an idea of the high qualifications necessary in a pilot, but other papers on the programame deal with this, so I will leave it to them to establish the connection of medicine and aviation.

THE SELECTION OF AVIATION PERSONNEL[1]

By Lieut. PAGE O. NORTHINGTON
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THERE is no more fundamental problem offering itself for solution and devolving upon our corps a greater responsibility, from the view point of military efficiency as well as that of a humane and economical consideration, than the selection and maintaining of a fit aviation personnel. And it is the selection of aviation personnel with some of its considerations peculiar to the Navy that prompts the following discussion which appears timely in view of the large percentage of candidates who, having passed a preliminary examination, either fail on the special examination or subsequently discontinue training for the reason of being temperamentally unfit.

Twenty-five per cent of the candidates reporting for the last class failed on the special examination, and waivers were granted on 35 per cent of those that were accepted. Thirty per cent of those beginning training have discontinued. It is a reasonable estimate that not more than 50 per cent of candidates reporting for the special examination and training will be qualified as aviators, which will be a loss to our government of more than a million dollars in training expenses in addition to the loss in prospective aviation personnel. The more rigid examination adopted for candidates entering subsequent classes is likely to disqualify even a larger percentage than in the previous class, if more unsuitable material is not eliminated in the preliminary examination.

We are well aware of the development of this important auxiliary force and that the undertaking of training student aviators demands the duty of specially qualified personnel as instructors. The course of training is long and at an enormous expense, and the obligation is ours to lend every cooperative effort within our province to the end that each class has its full quota of students and of those who are the most suitable aviation material.

The impetus given to aviation construction by the early recognition of the importance and possibilities of this auxiliary force during the World War resulted in an epoch in man's achievement in the construction of wood and wire. The greatest intellects in construction and engineering have interested themselves in the development and perfection of aircraft, and the momentous progress has resulted in a construction based on such mathematical precision and functioning in

[1] Read at the 30th Annual Meeting of The Association of Military Surgeons of the United States, Washington, D. C., October 12-14, 1922.

accordance with certain definite laws of aerodynamics which provide a high safety factor if the human mechanism does not falter. The pilot, adaptive man in this new sphere, did not excite a worthy medical interest in the early history of aviation, and it may be said that we marveled as the layman did at the psychology of the individual who dared to take such hazardous chances. During the first two and a half years of the World War the pilot was not selected because of any peculiar fitness for the air service, and if he "had the nerve" no one questioned his suitability based on any particular mental or physical standards. There were officers, who had failed to maintain the physical requirements in other branches of the service or even disqualified by reason of wounds or disease, relegated to the air service. Whether or not the exigency of the personnel situation among our allies justified the procedure, the great losses as a result in aviation personnel and matériel, in view of our present knowledge, appear to have been avoidable. The research work and the practical application of deduced theories have been fruitful in this important branch of military medicine and provided an acceptable though not immutable standard of mental and physical requirements. The examination includes many special tests, some employing special mechanical devices; however, if the preliminary examination is sufficiently thorough, the failures on account of not meeting with the requirements in the special examination will be negligible.

The candidates for admission to our aviation service are graduates from the Naval Academy and have had a minimum sea duty of three years. They are psychologically and physically suitable for their duties as line officers. They have learned, lest they not survive their apprenticeships as midshipmen and subsequent service as officers, the asset of a ready adaptability to a new environment and a keen appreciation of successful endeavor, which will enable them to easily conform to methods of this Service Training School. They are cognizant of the fact that in qualifying as pilots it is merely a means of performing the duties of naval officers in a different sphere than aboard ship. It cannot be supposed that because they are qualified for sea duty their vital organs will not falter when subjected to the intensity of stress and strain in their training and future duties as aviators. There are limitations which make it impossible for the examiner to determine who are going to develop into capable flyers; however, if a candidate measures up to certain physical standards and has, so far as we can estimate, a suitable temperament, we have a reasonable cause to expect success. It is a judgment based on the examination of the human machine at rest of how each part will function individually and collectively under entirely different and more trying conditions.

The younger officers, between the ages of twenty-one and twenty-six years, of good physique and showing proficiency in athletics, are the best aviation matériel. Their temerity is tempered with precaution, and their resiliency and prowess in athletics are more likely to remain during this optimum period.

It appears that the unmarried make the most successful aviators; at least there are weighty reasons why family responsibilities tend to impede their progress as student aviators. They are subjected to probably greater dangers, while in training, than at any time during their future duty as pilots, and their mental attitude toward flying fluctuates. There is a passionate hope one day and remorseful disappointment the next, and it is most certain that the responsibilities of wife and family weigh heavily upon their souls during these trying days.

It is not sufficient for candidates to merely have normal vision and hearing, and normally functioning cardio-vascular and nervous systems in their accustomed environment, but it is essential that their reserve in each be great enough to permit the most rational functioning of their mental powers resulting in the maximum promptitude and accuracy of action in their unnatural sphere.

If candidates have normal visual acuity and color perception and there is no strabismus or heterophoria, and no spontaneous nystagmus or disease of the eyelids, a very small percentage will fail to comply with the requirements of the special tests for the eye. The same may be said of the ear examination if the hearing is normal and there is no history or evidence of middle ear disease and the Eustachian tubes are unobstructed.

The heart must be free from any suggestive signs of organic disease and all murmurs other than those clearly of cardio-pulmonary origin are interpreted as probably indicating structural cardiac changes. Cardiac arrhythmia does not necessarily mean cardiac disease, and those irregularities most commonly found in the type of individuals from which our aviators are selected are not such as to disqualify them. Sinus arrhythmia and extrasystole are not uncommon in young, healthy individuals and do not alone indicate an ill-functioning cardiovascular system. In the event that the candidate has himself observed the "rate change on respiration," "thumping" or "missed beat," it is well to consider this subjective phase in connection with the study of his nervous system.

A candidate having paroxysmal tachycardia will not be likely to present himself for examination during an attack, and if there is any suggestive history, a pulse recorded at short intervals over two or three

days may confirm the suspicion or give a reasonable assurance of the non-existence of the condition.

The anxiety of an examination frequently causes an increase in the heart action of nervous origin. If the pulse rate does not come within normal limits during the period of the examination, the rate may be lowered by having the candidate lie down for a short time, or the rate will be lowered or remain the same following a brief physical exercise. This evidence of nervousness is viewed in connection with other signs of nervous instability that may be present.

Our candidates having cardiac derangement are more likely to show early signs of an irritable heart than that of organic cardiac disease or any arrhythmia of pathological significance. The irritable heart or effort syndrome, as this latter phrase indicates, presents its chief symptoms in response to physical effort and psychical disturbances. This disorder is frequently met with in those individuals whose family or personal history shows evidence of an unstable nervous system. The usual stress of life has not been borne without an unusual expenditure of nervous energy. The examination of the heart shows no structural changes and the signs under ordinary methods of examining may barely suggest this symptom-complex; however, functional tests of the efficiency of the cardio-vascular system may provide us with important information. It is little expected that one living under conditions aboard ship and accustomed to the performance of certain routine duties which do not subject him to physical or mental strain will present frank symptoms and signs of this disorder. The more common symptoms are breathlessness, tiredness and exhaustion brought on by slight exertion, giddiness and faintness associated or not with effort and postural changes, precordial pain, especially accompanying exercise, headaches, insomnia and irritableness, and the signs are an increased and irregular heart action with an exaggerated response to exercise and emotional disturbances, tremors of fingers, tongue and eyelids, clammy and cyanotic hands and feet. The pulse is poorly sustained, and this is intensified in the radial on raising the arm above the head, or a discrepancy may be noted with one arm in the horizontal and the other in a vertical position. On inspection the signs of a healthy peripheral circulation are not present, in that the hands, lobes of the ears and lips are not ruddy in appearance and the color slowly returns after pressure. The importance of eliminating prospective aviation material having incipient symptoms of this disorder is emphasized by the fact that aviators who do not possess the average endurance and are subject to easily induced "staleness" have an asthemic circulatory system.

It will be noted that many of these symptoms accompany endocrine

dyscrasias, especially hyperthyroidism, and if the glands of internal secretion are the etiological factor in these abnormal cardiovascular manifestations it is more obvious that the candidate is unsuitable for aviation duty.

Any practical test of value in estimating the efficiency of the cardiovascular system must be carried out with accuracy in time and type of exercise prescribed and under conditions when the candidate is calm and composed. The "Schneider Index," a test used in the special examination, recommends itself because of its simplicity and no special apparatus being employed, and because the interpretation of results is based on a broad clinical observation. It is a standardized test which eliminates practice effect and provides more accurate information than our opinion whether the response to a test appears normal, subnormal or excessive.

The respiratory system must be free from any active or latent disease and obstructions in the upper air passages. It is not solely a question of whether or not the signs elicited on percussion and auscultation are normal, but whether the important function will be maintained proficiently in the atmospheric conditions found at different altitudes of flying. When the pilot varies his altitude with rapidity, almost instantaneous compensations must be made, in order that the life-sustaining fluid may be adequately supplied. There is no satisfactory test for measuring the vital capacity; however, the "breath-holding test" may be employed as evidence in borderline cases. The candidate should be able to hold his breath for at least forty-five seconds, with full inspiration and nose clamped following expiration. A good physique, reaction in athletics demanding endurance and chest measurement and expansion, with no disease or nasopharyngeal obstructions, provide a valuable criterion to go by in a final judgment.

It is not necessary to labor the subject of organic disease of the brain and cord as it is extremely unlikely that defects of this nature will be present in the personnel from which our aviators are selected. The examination of the functioning of the nervous system and the study of the temperamental qualities of our candidates are of the utmost importance, and the examiner's final conclusion as to whether or not the individual will show aptitude and withstand the nervous strain of flying is at best an opinion. The examiner cannot be expected to possess a superhuman prognostic acumen that would enable him to only accept those men who will subsequently develop into proficient flyers; however, one's prophetic sense will be keener if there is a knowledge of the more common signs, clinically and in the history of those failing under instruction on account of being temperamentally unsuit-

able, and in having in mind a certain ideal standard of qualifications.

"An Analysis of Causes of Breakdown," by Gilchrist, Royal Medical Air Force, indicates quite clearly that most of the temperamentally unsuitable have some functional disturbance of the nervous system, evidenced in the family or personal history, or in the examination. The family history must be free from a psychopathic taint; not sufficient is it that there be no definite psychosis, but psycho-neurotic manifestations that may result in an inherited nervous instability. The personal history must be searched for signs of nervous instability appearing in childhood or adult life as chorea, enuresis, speech disturbances, convulsions, habit spasms, phobias, asthma and hay fever. Syphilis, even when early treated, and chronic malaria are causes for rejection. The physical signs that should excite a grave suspicion are exaggerated deep reflexes and muscular contraction to stimuli applied anywhere in the extremities, increased psychomotor tension, persistent dilatation of pupils, tremors of the fingers, tongue or eyelids, clammy cyanotic hands, and an inability to balance on one foot. What is to be our decision as to those candidates presenting symptoms suggestive of only slight functional derangement of the nervous system? Have we obtained all the information available for the most accurate conclusion? I believe that the temperamental manifestations of the individual—and by this I do not mean whether or not he is sanguine, phlegmatic, optimistic, or pessimistic, but rather those presentations of his nervous make-up in his habits, attainments and everyday life aboard ship—will give the examiner a rational basis for an opinion of the candidate's suitability for the aviation service. The living conditions aboard ship, with the close associations, provide the medical officer with valuable information of the traits of personality of those officers on the ship appearing for the preliminary examination, and it is pertinent to determine if there are psychotic personality trends. Is the individual seclusive, over-active, depressive, unstable, suspicious, egotistical or irritable and to what extent do they confirm the suspicion of an unstable nervous system?

Our candidates have passed the formative age, and it is not to be supposed that habits, though they may impair their efficiency, will be corrected by virtue of duty in the aviation service; on the other hand, they are more likely to be accentuated. Dissipation in any form, and a spirit of unwillingness to keep one's self in the best of condition, is an obvious handicap especially to student aviators. Sixty-six per cent of the crashes at the training station over a period of one year, 1921, occurred on Mondays or days following other holidays.

The motive for choosing aviation duty does not appear to be as

important as the individual's tenacity of purpose and loyalty that carry him through to a successful conclusion in any undertaking he assumes. This is a worthy attribute provided his physical and mental qualifications permit the fulfillment of his ambition.

It is difficult to formulate a standard of qualifications that is immutable; however, the following, with omissions not applicable to the Naval Air Service, are given by Longacre as conducive to efficiency and representing the optimum type:

(*a*) Youth.

(*b*) Celibacy.

(*c*) Good family history.

(*d*) Few and only minor diseases, especially those with few complications and sequalae.

(*e*) No operations or serious injuries.

(*f*) Extreme moderation in use of, or complete abstinence from tobacco.

(*g*) Liking for normal amusements—no evidence of excesses and dissipations.

(*h*) Evidences of manual dexterity—good at billiards, golf, sailing, violin, piano, horseback riding.

(*i*) Abstinence from alcohol and drugs.

(*j*) Good appetite and digestion.

(*k*) Normal sleep and absence of dreams; normal sexual tendencies.

(*l*) Good, active, sympathetic cooperation of family.

(*m*) Normal reaction throughout examination.

(*n*) Satisfactory physical examination.

(*o*) Personality showing.

a. *Temperament*.—Cheerful, stable, self-reliant, aggressive, punctilious, serious, good co-operation in work and in examination, good sportsmanship, moderate tension, enthusiastic, adaptable.

b. *Intelligence*.—Precise, penetrating, sharp, alert, resourceful.

c. *Volition*.—Energetic, quick, deliberate or moderately impulsive, controlled, good tenacity of purpose.

REFERENCES

Sutherland, G. A.: "The Medical Examination of Aviation Candidates." The *Lancet*, Vol. II, 1918, p. 803.

Rippon, T. S., and Manuel, E. G.: "The Essential Characteristics of Successful and Unsuccessful Aviators." The *Lancet*, Vol. II, 1918, p. 411.

Gilchrist, N. G.: "An Analysis of the Causes of Breakdown in Flying." British Medical Journal, Vol. II, 1918, p. 401.

Longacre, A. C.: Notes in "Personality Study," Research, Laboratory and School for Flight Surgeons. Air Service Medical, U. S. A.

MEDICAL ASPECTS OF NAVAL GAS WARFARE[1]

By Lieutenant G. H. MANKIN
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FROM the subject of this paper it would appear that naval gas warfare is an established fact and that from the medical standpoint the chief consideration lies in finding and putting into effect the best method of handling and caring for those exposed to and affected by gas. This, as we all know, is scarcely true—the use of gas in naval warfare has never been authentically reported. However, there is one report which is very suggestive of this use of gas. During a patrol in the North Sea, a squadron of British destroyers encountered a number of German destroyers and immediately gave chase. While passing through the smoke produced by the German destroyers, a number of men in exposed positions on H. M. S. *Botha* experienced symptoms not unlike those produced by the ordinary sneeze gas, di-phenyl-chlor-arsine. It is definitely known that this material is adapted to this type of employment, is efficacious in very high dilutions and will withstand fairly high temperatures without destruction or alteration of its properties.

It is inconceivable that a weapon which was capable of producing approximately 30 per cent of the total American casualties on land in the World War would not at least be considered in connection with its adaptation for use at sea. From various quarters we hear expressions setting forth the feasibility of this use of gas. May I not quote from that excellent book, "Chemical Warfare," by Fries and West? Under the discussion of the naval use of gas we find the following:

> We now come to the consideration of the Navy. The Navy will use gas both in its guns and in smoke clouds, and in some form of candle that will float. The toxic smokes that in high enough concentrations will kill, are extraordinarily irritating in minute quantities—so minute they cannot be seen or felt for a few moments. Every human being on a ship must breathe every minute just as every human being everywhere must breathe every minute or die. A gas that gets into the ventilating system of a ship will go all through it, and the Navy realizes it.
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> The Navy is studying how to keep the gas out of their own ships and how to get it into the enemy's ships. The toxic smokes may be dropped from aeroplanes or turned loose from under water by submarines. In either case they will give off smokes over wide areas through which ships must pass. Any defects will let these toxic smokes in and will force every man to wear a mask. Aeroplane bombs will come raining down on the ship or alongside of it either with toxic smokes or

[1]Read at the 30th Annual Meeting of The Association of Military Surgeons of the U. S., Washington, D. C., October 12-14, 1922.

other terrible gases. White phosphorus that burns and cannot be put out wet or dry will be rained on ships. Yes, chemical warfare materials will be used by the Navy.

The use of gas against landing parties or to aid landing parties has come up in many ways. Our studies to date indicate that gas is a greater advantage to the defense against landing parties than to the offense. Mustard gas and the like may be sprinkled from aeroplanes, and while it will not float long on the water, it will float long enough to smear any small boats attempting to land. It can be sprinkled over all the areas that landing parties must occupy. Mustard gas may be placed in bombs or drums around all areas that are apt to be used as landing places and exploded in the face of advancing troops.

All discussion of gas warfare, whether on land or at sea, must necessarily be considered in the light of the restrictions imposed by the treaty on poison gas and submarines, promulgated by the recent Limitation of Armament Conference. These restrictions are, of course, binding only upon the signatory powers, but do not prohibit any party to the covenant from using these arms in any manner seen fit or expedient in a conflict with nations not signatory to this treaty. This agreement, then, operates not to eliminate gas warfare from consideration nor does it minimize its importance, but rather it limits the scope of its application, in that fewer nations are liable to use it. It does not remove the necessity for continued and extensive research in matters connected with defense and in devising the most efficacious methods of treating and handling late, as well as recent, cases of gas warfare poisoning.

While the Army and Navy face fundamentally the same problem there are many important details in which the Navy's task is different from that of the land forces, and again there are times when the problems of the naval medical officer are identical with those of the army medical officer. I refer to service with Marines on expeditionary duty. During the World War the naval medical officers serving with the Fifth and Sixth Regiments of Marines had to cope with situations and solve problems in every respect comparable with, if not the same as, those confronting army medical officers on similar duty.

It is proposed at this time to discuss, in general terms, the results to be expected from the enemy use of gas at sea, and the methods for combating or minimizing the effects of gas so used.

In contemplating the materials which, one feels, would lend themselves readily to use in naval gas warfare, one is at once struck with the fact that only a comparatively small group possesses the attributes ordinarily considered prerequisite in a gas which is to be used in this manner.

Most naval battles are fought at long ranges, and most of them are of short duration and are quickly over with. The prime consideration

is the destruction of matériel. If reduction of the efficiency of personnel or incapacitation of personnel can be accomplished quickly and easily by gas and thus render a ship more readily destroyed, it is an advantageous method to use. A gas, the effects of which are realized hours after the ship returns to port, is of less importance and of less military value. For this reason, it is not believed that gases having a delayed or late effect will be seriously considered for use at sea; however, it is dangerous to cease making preparations to cope with all gases, for experience gained in the recent war indicates that the gas actually used is often the unexpected one. Furthermore, a given gas often has its common characteristics somewhat altered, depending upon the method of releasing; for instance, mustard gas in shells, having a comparatively large amount of high explosive, is more deadly than in the shell containing only sufficient explosive to burst the container. The high explosive distributes the mustard gas in the form of a fine spray, and one may draw into the lungs at a single inspiration much more gas than under ordinary circumstances. This and other examples that readily come to mind teach us that no toxic gas, vapor or smoke is without suspicion as a naval warfare gas. During a war the list of gases to be feared and considered will vary from day to day as tactics change and as new gases are developed and as new methods of using old gases are evolved.

Assuming, then, that all toxic gases are to be considered potential naval war gases, we must next conjecture as to the probable method by which they will be delivered on board ship. There come to mind at once the following means: (1) Smoke screen; (2) shell fire; (3) aircraft bombs; (4) aircraft spray; (5) smoke boxes; (6) gas torpedoes; (7) gas mines.

They have been placed in the order of their probability of use as a method of offense. The smoke screen is placed first because it is believed that it can be laid effectively, rapidly and comparatively safely in the early skirmishing of a naval battle at the very time when its moral and strategic effect would be greatest.

Modern armor-piercing shells could no doubt be used very well as a vehicle for carrying gas. The preference in this case would be for a solid material, owing to the fact that the ballistics would undoubtedly be interfered with if the shell carried a liquid. One immediately asks why an armor-piercing shell should carry gas if the primary object in a naval battle is, as was previously stated, to destroy matériel. Why not use high explosive alone, for it is sure that, if a high explosive shell explodes in a compartment, all personnel in that compartment will become casualties anyway? This is quite true, but ventilation, either artificial or natural, can be counted upon to distribute any toxic vapors

in one compartment to adjacent ones or even ones some distance from it. Warm ground ashore produces upward currents of air, dispersing and distributing heavy toxic vapors. Warm steel decks on board ship can be expected to do the same thing, and we may come to the paradoxical situation in which gases, heavier than air, actually float upward. Voice tube communication provides another method in which gas, having entered a ship, may be distributed to remote parts.

Aircraft bombs provide an excellent method of getting gas aboard a ship. It can be done quite accurately and with comparative safety and, certainly, quite effectively.

The use of toxic smoke boxes, gas torpedoes and gas mines, while not impossible, yet constitute the more improbable methods.

Preventive and prophylactic measures against gas at sea constitute the most important consideration for naval medical officers in connection with this new offensive arm. After the personnel is affected, the routine treatment, of which so much has been written, is applied. This need not be gone into here. It suffices to say that with an abundance of medical supplies, instruments, sterilizers, facilities for transportation of sick and wounded, hot and cold water, and steam connections with facilities for heating compartments, such as one finds on capital ships, the ordinary difficulties attendant upon treatment of gas cases in the field will not be found.

Preventive or defense measures to be undertaken may be classified under several distinct headings.

1. *Ship protection* through maneuvering of the vessel in such a manner as to place it to windward of a gas cloud or toxic smoke screen or at least to permit it to remain in such a screen or cloud for the briefest possible time, providing, of course, this does not interfere seriously with the battle tactics and strategy.

2. *Group protection.* This type of protection is applicable where numbers of men are working together in the same compartment or room and where the activities of the men so engaged are confined to this room. Furthermore, the room must be small and of such construction as to be readily sealed. Ventilation may be of the oxygen-soda lime closed circuit type with fans for agitation of the air or it may be of the plenum type with a large canister, containing absorbent material, over the intake. This, of course, is open to serious objection on account of the resistance of such a canister with the consequent cutting down of the amount of air actually delivered, but frequently one is not in a position to choose.

3. *Individual protection.* By this is meant the protection afforded by gas masks and is applicable to all despite the fact that in certain

cases it may be difficult of application. I refer to the inconvenience of wearing a gas mask while using a range finder and in other types of work of more or less similar nature. Every man should know how to adjust a gas mask, how to inspect and care for it; he should know its possibilities and its limitations.

4. Gas alarms must be devised or settled upon, possibly using the existing apparatus on board ship now utilized for general alarms, such as "abandon ship," etc. This is very necessary for acquainting all on board of the presence of toxic gas in order that they may take the proper steps to avoid the incapacitating effects of gas.

5. Localization of damage attendant upon enemy use of toxic substances constitutes one of the most important elements of gas defense. In this connection may be considered:

(*a*) Stopping of all ventilation, both artificial and natural, not absolutely necessary, with a view to confining the toxic vapors.

(*b*) Reversal of air flow in the ventilation system to rid a compartment of gas.

(*c*) Sealing and isolation of compartments which are gas ridden.

(*d*) Scavenging of gas by steam or sea water under pressure.

(*e*) Removal of toxic materials from bulkheads and decks by swabbing down with neutralizing agents.

(*f*) Protection of voice tubes and interior communication apparatus.

(*g*) Protection of guns and ammunition from the corrosive effects of toxic materials.

The methods mentioned above for combating and minimizing the effects of gas are natural corollaries of the use of toxic materials on land, as must be all of our deductions since gas probably has not been used at sea and certainly little experimentation has been done, but they are matters that must not be lost sight of and forgotten, for certainly they are potentialities.

MEDICINE IN THE REVOLT OF THE SIXTEENTH CENTURY—AN HISTORICAL SKETCH[1]

By HORACE MANCHESTER BROWN, M.D.
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IT IS with no small decree of hesitation that I appear before this association, made up as it is of men of distinguished attainments and recognized position in the medical and surgical world, for the purpose of presenting a paper upon an historical subject intimately relating to medicine, and to a period so remote in its method of thought and manner of reasoning when compared to that of the present time, as was the sixteenth century. But it concerns matters that are of the greatest importance to the medical world of our time, which, while considered by us to be axiomatic—unorthodox at the time when they were brought forward and adopted—were nevertheless fraught with such enormous importance as to have caused a complete revolution in medicine, and to have laid the foundation upon which all medical thought is based today. It is an old story, but it may amuse you.

In order to make the necessary comparison of the conditions of which I wish to speak, that are related to the advance in medicine in the sixteenth century, it will be necessary to lay the foundation for that comparison by making a short examination of the conditions of knowledge existing toward the end of the fifteenth century.

About the year 1276, the period of discussion by the school men of the various philosophies and theological ideas that had found a place in the thinking world, came to an end; and with the development and acceptance of the ideas of St. Thomas Aquinas (1220–1274), the Church, which ruled all of the Western Europe except a part of Spain, accepted his adoption of the philosophy of Aristotle (384–322 B. C.) as the basis for *its* philosophy.

St. Thomas Aquinas had developed a theory founded upon the Greek and Arabic renderings and discussions of the writings of Aristotle which established the idea that there are but two sources of knowledge; one, that acquired by *Reason,* the other by *Revelation.* The knowledge acquired by Reason was essentially that of Aristotle. The knowledge acquired by Revelation had for its foundation the Holy Scriptures and the writings of the Fathers of the Church.

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[1]Read at the 30th Annual Meeting of The Association of Military Surgeons of the U. S., Washington, D. C., October 13, 1922.

The philosophy of St. Thomas Aquinas was based effectively, in its relation to mankind, upon the human anatomy as taught by Galen.

Medical knowledge up to the beginning of the sixteenth century had for its basis the writings of Hippocrates (460–377 B. C.), of Galen, ob, 201), and of Avicenna (980–1037), the great Arabian philosopher, himself a disciple of Galen.

Although much had been written by many of the Semitic physicians, yet out of the long list of names of those Arabians who wrote upon medicine there are but two who can be said to have attempted in any way to question the conclusions of Galen. One of these was the Jew, Avenzoha, who died in the year 1161, and the Mohammedan, Averrhoes, who died in the year 1198. The whole medical profession of the western world was bound in the fetters of Galenism. Dissection was almost a lost art, and the only manual of anatomy founded upon dissection was a little book written about 1320 by Mondinus (died 1325), professor of anatomy at Bologna.

Anatomical illustration was as crude as the drawings of a six-year-old child upon his slate in a country school. Although the artistic side of life was beginning to be developed in Italy, *anatomical* illustration was in its veriest infancy, and even illustrations of the human outward form were almost caricatures, until the time when Leonardo Da Vinci, Michael Angelo, Raphael and Albrecht Durer began to produce drawings which bore some resemblance to the human figure. It is true that every medical student, before taking the doctorial bonnet, was supposed to have read and written a commentary upon the Anatomy of Mondinus, but it was not until the beginning of the sixteenth century that Berengario Da Carpi (1490–1550) produced in his Isogogue anything like a rational criticism of the product of the earlier Bolognese dissector. Medicine, theology, and philosophy had been for nearly 300 years in a condition of "Frozen Thought."

Throughout the whole western world at that time the opinions of Galen, in regard to the functions of the various organs of the body and their anatomical construction and relations, had become fixed, and were almost as sacred in the minds of medical men as were the precepts of the Fathers of the Church in theological circles.

The methods of education of men who were to occupy positions in society marked by a greater knowledge than that of the common herd were in almost all instances along the lines of both of the

sciences, religion and physic; and just as the edicts of the Church were not to be disputed by the theologians, so the edicts of Galen were considered fundamental truths, not to be doubted with impunity by the physicians.

The one great outstanding fact that differentiated the cultural progress of the sixteenth century is its remarkable development of revolt against the "Frozen Thought" that had ruled philosophy, medicine, and religion since the time of St. Thomas Aquinas and Pope John XXI, called Petrus Hispanus, he himself a physician, whose book upon logic, called "Summulae Logicales," had established a method of thinking, founded upon a system of syllogistic reasoning, which had produced paralysis of thought in almost all of the thinking world.

For us as medical men, the quarrels based only upon abstractions among the theologians are of but little interest, while the physiology of Galen, believed in and "frozen" since the beginning of the third century, is of the utmost importance.

Throughout all the years since his time there had been among all classes of thinkers: a persistent inquiry into the nature and location of the *soul* within the human body. Galen had followed his own dream and had believed that there were three *spirits* in the body, one of which was the *soul* itself. The Bible had taught "that the *soul* is in the blood, the blood is the soul." Galen found a spirit which he called the *natural* spirit abiding in the liver and the veins; a *vital* spirit abiding in the heart and the arteries, which latter vessels themselves contained air and a small quantity of spiritualized hot blood. Somewhere in the brain he located the *animal* or *soul* spirit which found its nourishment in the vitalized blood, which, mixed with air drawn into the left ventricle of the heart by way of the trachea, was carried to the brain.

In order to accomplish this vitalization of the air and of the blood in the left ventricle, it was necessary for him to imagine certain openings (foveae), very small in size and imperceptible to the eye, which connected the right ventricle of the heart with the left ventricle, through the ventricular septum. The whole medical world had accepted this theory, and that was the basis of human physiology, upon which the entire structure of symptomatology and medical treatment depended.

The heat of the body was generated in the heart, in the left ventricle. The blood was made in the liver and was carried to the lungs to be cooled, and thence through the veins; thus nourishment and warmth were transmitted.

The great medical centers of the world, such as Salerno, Montpellier, and Paris, were prepared to defend these theories to the last ditch. One need not go beyond the few facts that have been stated, to convey to the mind of any medical man the absurdity of medical reasoning based upon this belief, or to make him realize how great was the revolution in the medical and theological world when anatomy in the first half of the sixteenth century began to be an exact science.

I think it may safely be said, that all *philosophy* is based upon a correct knowledge of *physiology,* and that the latter cannot be had without an *exact knowledge of anatomy.* To one who has given any considerable amount of time or effort to the study of history, there comes the impression that there are distinct periods—"psycho-vital periods," if you like—occurring at varying intervals, when the progress of mankind suddenly advances by leaps and bounds when compared with the dull and unprofitable eras that have intervened. Periods when mankind, tiring of the sameness of life and the unprofitable repetition of acts based upon worn-out theories, breaks away from the conventions that confine him and boldly steps forward into a world of protest and new things. In examining the condition of the civilization of the sixteenth century, particularly such a condition is notable in medicine.

One is astounded to note the number of events that bear directly upon the advancement of medical culture, from those conditions which had been but little changed through the fourteenth century, into a state of living activity, and, all things considered, a marvelous development. Partaking in the restlessness that had culminated in the revolt against the established religion came the revolt of medicine against the stereotyped forms and beliefs which, based upon the anatomy and physiology of Galen and supported by a theology based upon this belief, had become congealed almost beyond the possibility of change.

The latter end of the fifteenth century had been a portentous period in the field of religion. A number of agitators had arisen in different parts of Europe, and most of these, with their following, had been crushed by the almost boundless power of the Church at Rome. In Florence, in the year 1498, Hieronimus Savonorola had given his body to the flames rather than retract his criticisms of the morals and methods of the governing powers at Rome. Christopher Columbus had returned from his epoch-making voyage of discovery, and the mercantile world was in a state of confusion

under the belief that a new pathway had been found to the Indies.

Ignatius Loyola (1491–1556), born at the latter end of the fifteenth century and still bearing upon his body the unhealed wounds that he had received at the battle of Pamplona, was laying the foundation and carrying on the propaganda which resulted in the development of that great priestly body known as the Society or Company of Jesus. The Loyolan principle was that of absolute conformity to the dictates of the Roman Church, and was in obedience to the theory of "knowledge acquired by revelation." In his Exercitia Spiritualia: Cap. De Regulae Aliquot Servandae ut cum Orthodoxa Ecclesia vere Sentiamus Regula, No. XIII, Loyola says: "In order that we may be in exact and unanimous accord with the Catholic Church, if that which appears to our eyes as white, is defined by it as black, at once we ought to pronounce it black."

In another quarter of the world, Martin Luther (1483–1546), revolting against certain methods of the Church and its government at Rome, was setting the European world afire with his eloquence and promulgating those ideas which were to produce vast changes in the attitude of the people of Europe toward a religion which had been established for nearly 1,500 years.

But it was not alone along the line of religious thought that the civilized world was undergoing an upheaval.

The sixteenth century had its beginning in the midst of these confusions of business, discoveries, religious animosities; and the things of life which had been supposed to be fixed factors in the existence of governments and individuals were repeatedly being undermined by dissenters from the established order. This was particularly true in regard to the attitude of the civilized world toward the medical profession.

Bound as was the medical world to the teachings of Galen in regard to anatomy and physiology, and to the Arabians in regard to therapeutics and surgical procedures, it was open to the bitterest criticism from the limited number of men who had the courage during its earliest years, to revolt, with pen and the spoken word, against the conditions that had existed for so long a time that dissent from the truth of their teachings was almost heresy.

In the writings of Hieronymus Cardanus, himself a physician (1501–1576), we find a most bitter criticism of the medical faculty of his day and, speaking of them, he says, "beside this those who call themselves physicians kill a great many more than they cure.

It is far better to cure without medicines than with them. The whole tribe of physicians is a pestiferous band: yet medicine is a true art, and all sick people may be healed (sanare) who suffer from the mistakes of nature."

Shortly following him comes that iconoclastic critic of all things human and divine, Cornelius Agrippa of Nettesheym (1486–1535), who was been spoken of as "one who without fear, praises, scorns, understands, ignores, laughs and rages, dissects and tears open all things of the established order"; and that estimate of the man is quite within the limits of the truth. He says: "Such are the evasions and mendacities of the physicians, that it has become a saying among the common people, that 'He lies like a Doctor.' " Indeed, a large part of the famous "Macoronicorum" of Folengo (1491–1544), a friend and crony of Leonardo, is a caustic satire upon the medicine of this time.

These beginning years of the sixteenth century saw the birth of two men, one of them in Spain and one in Belgium, the former of whom was in his theological reasoning to conceive, while endeavoring to locate anatomically the soul in the human body, a theory in regard to the path of the blood in the lesser circulation that was a direct denial of all that had been taught since the time of Hippocrates; and the latter was, through his peculiar capacity for intelligent investigation of the anatomy of the human body, to lay the foundation upon which the entire modern structure of medicine was to rest.

Both instances were evidences of *open Revolt of Reason against Authority.*

Michael Servetus (1511–1553), the first of these, was to die at the stake, in Geneva; and the second, Andreas Vesalius (1513–1564), by starvation, on the Island of Zante, after shipwreck. One the victim of Protestant bigotry, the other while returning from the Holy Land after a penitential journey at the command of the Inquisition.

Bearing in mind the anxiety of the learned world of that time as to the location of the soul in the body and the "frozen faith" of the medical world in the truth of all that had been stated by Galen, it can be readily seen that any pronouncement of any theologian or any expression of doubt on the part of any physician was anathema, and worthy of the most condign punishment at the hands of the authorities in both branches of learning.

Anatomy had made but little progress under the observation

of the Arabians, for it was contrary to their religious law to mutilate the human body after death, and whatever may have been the intentions of the famous Bull of Pope Boniface VIII (died 1303), entitled "De Sepulturis," its practical results had been to strangle all forms of dissection in all countries under the religious control of the Roman Church. (Vide Anathomia Mondini, Cap. XXXVI, De Anathomia Auris.)

The greatest influence in the medical world in regard to such matters was Jacobus Sylvius (1478–1555), at the head of the Surgical Faculty of the University of Paris. He was a firm believer, as was all of the rest of the medical world, in the apodictical truth of all that Galen had written, and even after Vesalius, through many years of dissection, experience and demonstration, had produced that marvelous book, "De Fabrica Humani Corporis," in his anger at the progress that had been made in spite of the Galenic legend, he even wrote a book in which he transforms the name of Vesalius into the Latin word "Vesanus" meaning "insane."

The book of Vesalius was the best possible advocate of his ability, and its appearance caused a sensation throughout the cultured world in Europe. Its illustrations by Calcar (1499–1546) a pupil and imitator of Titian (1477–1576), were the first, even approximately correct, presentation of the anatomy of the human body that had ever appeared.

When one is following out a course of investigation of a subject relating to the history of so great a part of civilized activity as that comprised within the field of medicine, one sometimes finds himself apparently straying far afield, as he goes seeking for the original manifestations of such a great upheaval as that which took place in the world of learning at the period of which this paper treats.

The Hussite schism which took place about 1415, when carefully studied, is not without its medical bearing upon the attitude of revolt against the things as they were at that time, and if we take a jump through half a century, coming to the year 1486, we find that great student of philosophy and theology, Pico de la Mirandula (1463–1494), at Rome, bearing with him 900 conclusions relating to philosophy and religion, which he proposed to defend publicly before the greatest theologians and philosophers at that seat of the highest learning.

It is a tremendous task even to glance through this enormous catalogue of propositions, but the medical man who is a student

of history finds, even in a cursory survey of these conclusions, many which have a direct bearing of complaint against the religio-medical attitude of the learning of that period.

If we are to believe the writings of Theodoric (1205–1296) (denied the need of pus), in which he gives an account of the surgical activities of his father (?), Ugo di Lucca, when acting as surgeon during the Crusades, we will be led to believe that at that early period surgery had made great advances and that in many aspects the sixteenth century was a period which evidenced a remembrance of the almost forgotten work of the "Soldiers of the Cross."

However this may be, it is something aside from the purposes of this paper; and its discussion would lead me too far afield. Let us return to our sixteenth century and permit me to signalize the name of a man but little heard of in a book on the history of medicine, and yet whose influence seems to have been very great upon many of the generation of young men who became prominent during that era. Jean Gonthier (born 1487), called usually Gunther of Andernach, seems to have been one of those men who—himself one of the restorers of Greek learning and one of the most active translators of the Greek writers, as well as one of the most zealous students of anatomy—in his great love of learning and in his position as Professor of Greek at Utrecht and Louvain, had by chance the opportunity to exert by his influence a great force in determining the characteristics of some of the men who in the middle of the sixteenth century were to be extremely prominent in the field of promotion of the progress of the medical sciences. Sylvius, Vesalius, Michael Servetus, Rondeletus the surgeon, and Fernellius were either his companions or his pupils, and it would seem that this man, who did so much for placing a knowledge of Hippocrates, Aristotle, and Galen within the reach of the western world, should have the measure of recognition that is his due. It is essentially to Gunther of Andernach that we owe the journey of Vesalius to Paris to study under Sylvius, and later on, to the appointment of Vesalius to the position of Professor of Anatomy at Padua. Andernach's translation of the account by Rhases (860 circa 940) upon Small Pox and Measles, under the title "Account of the Pestilence," was its first rendition into Latin.

As regards the great advance that was made in medicine during the sixteenth century, an advancement which was an evidence

of the tendency to revolt against all the older things, one must particularly specify that this advancement took place especially along the lines of anatomy, and a speculative process of thought in physiology, which was based mostly upon the newer anatomical knowledge, but partly upon the problem of the search for the anatomical location of the soul in the body.

The one outstanding figure in the field of anatomy since the beginning of recorded time is that of Andreas Vesalius, born in Brussels in 1514, on the 13th day of December. His ancestors for five generations were either physicians or apothecaries.

From his earliest youth, while engaged in his studies of Latin and Greek under the tutelage of Gunther of Andernach at Louvain, his special amusement seems to have been that of the study of the physical structure of all kinds of animals and he, even before he was 16 years of age, succeeded in dissecting, at least partially, the bodies of several criminals who had been executed; and had already possessed himself of the dried bones, still held together by their ligaments, of a criminal hanged in chains. At the age of 19, after having spent some considerable time at Paris under the very inefficient teaching of Sylvius, we find him again at Louvain, making public demonstrations of anatomy from dissections of the human body. At the age of 20 years he was surgeon in the army of the emperor Charles V. Thence he went to Venice, where he gave public demonstrations of anatomy to all comers, and at the age of 25 years was Professor of Anatomy at Padua, in the university. This was the first purely anatomical professorship; and Vesalius was the first to teach anatomy and receive a regular salary, drawn from the funds of any university, for so doing.

Realizing the small value of the anatomical teachings of Galen and all other writers up to his own time, at the age of 25 he determined to write a treatise on anatomy that should be based upon his own observations upon that science, as demonstrated in the human body under the scalpel of the dissector. The fruition of this resolution was his monumental work "De Humani Corporis Fabrica," published in 1543 by Oporinus of Basel.

Thus was laid the foundation stone upon which has been built the great edifice of modern anatomical knowledge.

At the end of 1543, when 29 years of age, we find him at the court of Charles V at Madrid, as first physician to that emperor. Here prosperity seems to have overcome his scientific ardor, and his quarrel with Fallopius, his former pupil, over some points in

the anatomy of the bones of the skull, stands witness to the enervating effect of prosperity and adulation.

Upon the abdication of Charles V in 1555, Vesalius became physician to his successor, Phillip II. Finally in 1563 or 1564, while doing an autopsy upon the body of a nobleman who had died a mysterious death, some of the lookers-on thought that they saw the heart move after the thorax was incised. These men brought against him the charge that he had cut open a human body before life was extinct. This charge brought Vesalius before the Tribunal of the Holy Inquisition and he was condemned to death, but this condemnation was softened to an order that he should make a pilgrimage to the Holy Land.

Returning from Palestine, his ship was wrecked on the Island of Zante, and Vesalius alone of all the company was cast ashore. There he died of starvation in the year 1564, not having achieved his fiftieth year.

The story of his life is the romance of anatomy.

The particular point in the work of Vesalius, which refers to the physiological problems of the sixteenth century, is that in the "Fabrica" of 1543 (book VI, Cap. XI, page 589) he mentions the foveae or openings through the ventricular septum—apparently in respect for the teachings of Galen—but he particularly states that "they are in no way capable of being discovered by the senses." This was the first direct attack upon the anatomical framework of the physiology of the existence of the three spirits and their location, as had been taught in various forms for more than 1300 years. There had also been taught, since the days of Hippocrates, the theory that the arteries contained air. Of this matter Vesalius says in effect (book VII, Cap. XIX, page 650): "If you wish to know about this, open an artery in a living animal and it will be clear that they contain pure blood." It is interesting to note, in estimating the tenacity with which old and already discarded theories cling to the convolutions even of the scientific brain, that as late as 1640 we find Gassendi 1592–1655), the great philosopher, stating that he himself had seen the perforations demonstrated; and he gives a full account of the fact in the book published by Pinaeus at Leyden in that year, while our own Benjamin Franklin as late as 1745 was still discussing the problem of the "attractive power of the auricles and ventricles."

The chair of anatomy at the University of Padua was, until the succession to the professorship of Fabricius in 1562, only an

accessory to the chair of surgery; nevertheless the three great names which stand out most prominently in the list of men who taught in the medical school in that city are those of the anatomists.

Vesalius retired from his position in the year 1546, and his successor was Gabriel Fallopius of Modena (1523–1562), who, next to Vesalius, is the most outstanding figure in the history of anatomy of the sixteenth century. At twenty-four he was professor at Ferrara and at Pisa, and, following Vesalius after having studied under him, he became not only his most ardent admirer but also so acute and able an investigator, as to be able to make many corrections of the work of Vesalius, as is shown by his book, published in 1561, under the title of "Observationes Anatomicae." Nearly a hundred new and exact discoveries were made by him. His pupil, Jerome Fabricius Ab Acquapendente (1537–1619), at about the year 1574, described fully and for the first time the valves in the veins, but Fallopius was unable to agree with this discovery, for the reason that, making his investigations upon the azygos veins in which there are no valves, he concluded that Fabricius was in error. The fame of Fallopius was so great that many books were published, some on anatomy, some on folk-medicine, bearing his name, with which he had nothing to do.

An annotator of his work on anatomy, shortly after his death, made many statements in his name, many of them false, for which he was manifestly not responsible. Immediately following the death of Fallopius in the year 1562, his pupil Fabricius became Professor of Anatomy at Padua and added greatly to the already brilliant reputation of that school by his extremely clear and correct description of many muscles and his corrections of the mistakes of Vesalius and of Fallopius.

The name of Fabricius is especially connected with the discovery of the valves in the veins. There can be but little doubt that Guy de Chauliac, in the previous century, had already noticed these anatomical structures, but had failed to give them consideration. It is also to be doubted as to whether Fabricius fully understood their purpose, and since the time of the discovery of the circulation of the blood by Harvey, in the year 1613, there has always been a difference of opinion as to whether Harvey himself or the great rebellious monk, priest, philosopher, and student, Pietro Sarpi of Venice (1552–1623), was the first to have assigned to them their proper function.

This whole controversy depends upon a few lines occurring on page 20 of the life of Sarpi, by Fra Fulgencio, his friend and contemporary. From my personal investigation of this question—and it has not been a superficial one—I can find nothing even in the writing of Fulgencio to confirm the opinion that the honor of this discovery of the function of the "Ostioli" in the veins should be taken away from Harvey.

Fabricius died in the year 1619, rich in years and in pocket. His name stands out prominently, in the history of the sixteenth century, as one who by his clear understanding, rare intelligence, and ability as a physician and teacher added magnificently to the reputation of the Paduan School, to the world's knowledge of anatomy and to medical progress.

At this point it may be well to step aside for a moment and examine the matter of the recognition of the valves in the veins by various writers. I have already spoken of the recognition of their presence by Guy di Chauliac (end of fourteenth century). Mondinus (or Alessandra Giliani, his assistant) in his "Anathomia" seems to note their presence as early as 1320. In the year 1535 Carolus Stephanus (1504–1564), son of the great classicist Henricus Stephanus, at Paris, saw them and described them vaguely. They had not escaped the notice of Fallopius, Sylvius or Arantius (1530–1589). Caesalpinus, later, was the first to notice that there was swelling of the veins distal to a ligature.

About the middle of the sixteenth century a most distinguished physician and scholar, Guido Guidi (1500–1569), known by his Latin name as Vidus Vidius, at the request of Francis I of France went to Paris and became professor of medicine in the university of that city. He seems to have been a most lovable man and to have distinguished himself greatly not only as a scientific man but also as a courtier. He and Benvenuto Cellini (1500–1571) lived together in a house in the grounds connected with the palace, and Cellini, while he seems to have recognized the merits of Berengario Da Capi, was not able to speak of him in terms of very high admiration, while for Guido Guidi his respect, love and admiration seemed to have been unbounded.

Guidi himself, an anatomist of no mean pretensions, was one among the very first to recognize the enormous value of the work done by Vesalius. It is to be regretted that his own writings upon anatomy, which were very extensive and in which he accepts and elaborates the work of Vesalius, were not published during

his lifetime but were collected by his son, and being added to by him, first appeared as a part of the collected writings of Guidi in the year 1611.

In the section on anatomy are to be found many evidences of very advanced anatomical knowledge, but it is difficult to state how much of this was the actual work of Guidi and how much that of his son, who also was a physician.

The death of Vesalius in 1546 left the work of propagation of his anatomical knowledge largely in the hands of Guidi and Fallopius.

One of the remarkable incidents of this period of investigation which in a degree emphasized the hold that the influence of Galen had upon even the clearest thinkers in medicine is the story of the life and work of Bartholomeus Eustachius of San Severino (1500–1570). Eustachius was one of the most learned men of his time, and in spite of his strong leaning toward Galenism he gave to the world the first clear description of the normal and pathological conditions of the kidneys and first established the fact—which had been denied— that the right kidney is placed at a lower level in the body than the left. He differentiated the cortex from the medulla of these organs and advanced a palpably correct theory of the origin of stone. He made careful dissection of the ear and gave the first true description of the anatomy of that organ. His investigations within the abdominal cavity enriched our knowledge of the blood supply of the various abdominal organs, and to this knowledge he added the discovery and description of the suprarenal capsules.

While engaged in the dissection of a horse he discovered and first described the thoracic duct. He laid the foundation of modern dentistry by his investigations and descriptions of the fetal and infantile teeth development, as well as giving the teeth a true classification. He made many mistakes because of his loyalty to the Galenic ideas of anatomy, and in the plates of his famous "Tabulea Anatomacae" inserted drawings which, while they conformed to the Galenic ideas, were not in accord with his observed facts.

These plates had a most romantic history. The drawings, engraved upon copper plates, were made in the year 1552. They were lost for 150 years. Rediscovered in 1712, they were rescued and published in 1714 and 1728 at the expense of Pope Clement XI, under the care of Lancisi.

The contributions of Eustachius were of great value to the medical world in spite of their Galenism. He was a man of unbounded talent and courage, and his name today is in the mouth of every anatomist. His discovery of the thoracic duct was the beginning of that long chain of discoveries which ends in 1660, when Thomas Bartholin first demonstrated the general lymphatic system of the body.

It is not necessary that we should go further in citing the long list of men who, supported by the courage of Vesalius, continued his work during the latter half of the sixteenth century.

It is to be remembered that all of the anatomists of that period were surgeons and some few among them proved to be keen reasoners along physiological lines. I shall speak of them later.

Let us now glance at the record of two of the surgeons whose opinions made that period epochal in that branch of medicine. It is to be remembered that the sixteenth century was an era of continuous warfare. The list of disagreements between nations as to religion, as to politics and possessions is a long one and is as follows:

Contest of Charles V and France, Spain with Holland, France with England, Spain with England, Naples with Church, Venice with Church, Austria with Prussia, Sweden with Poland, Church with Bohemia, Internecine strife of Italian Principalities wth each other and with Rome, Luther with Calvin, Calvin with everybody, Dominicans against Jesuits, *et contra.*

It will be readily seen that in the surgical service in the armies there was great opportunity, particularly in view of the advancement of anatomical knowledge, for the development of newer ideas in regard to surgical injuries. I shall cite first the name of Bartolomeo Maggi, born in 1477, and who died in 1552.

Since the beginning of the use of gunpowder in war, which period we may safely state began with the siege of Boza in the year 1326, there had been a fixed belief in the medical mind that all wounds produced by projectiles were necessarily not only poisoned by the poisons in the wound, from the soot and dirt from the gunpowder, but that they also partook of the nature of injuries produced by burning. In view of the entire lack of proper hygienic surroundings among soldiers in the armies of this period, it is easy to understand that tetanus, secondary hemorrhage and gangrene were almost inevitable concomitants of gunshot wounds, and it is natural to suppose that from these conditions arose the belief in the poisoned or burned character of the lesion.

Maggi was essentially a surgeon to the armies, and he was the first to deny the poisonous character of gunshot wounds, or that they in any way partook of the characteristics of burnt or scalded lesions. It is also to his credit that he was the first among the moderns to demand that amputation should be made in cases of gangrene through the sound and living flesh; this in a way foreshadowing the modern ideas of "debridement" as practiced during the late war.

Realizing the importance of rapid operation in cases calling for amputation, he was the inventor of an instrument which might well be called the forerunner of the guillotine. It consisted of an heavy, long, sharp knife, fixed in a support with its edge uppermost. Above this was another similar knife with its edge facing downward. The limb to be amputated was placed between these two knives and a heavy weight was forced to fall upon the upper one, the two blades meeting or passing each other as the limb was separated from the body.

Maggi seems to have had a vague idea that pus formation was not necessary for the healing of wounds.

I do not need to go deeply into any recitation of the enormous value of the work of Ambroise Paré, of Laval (1510–1592), for that is familiar to all of you. I will touch but one point in regard to the common belief among medical men, that Paré was the first to use ligatures as a means of arrest of hemorrhage. This is not true. Galen himself recognized the function of ligature in controlling bleeding. The Arabian physicians were well accustomed to the use of that method as we find in the writings of Arnold of Villanova in the thirteenth century (?), possibly borrowed from Albucasis (died 1122), who described their use. (Chyrurgia, Pars. II, Cap. III.)

It is rather because of Paré's application of common sense and common cleanliness in the treatment of wounds with all that that meant, that has placed his name ever prominent upon the tablets of fame.

Among the moderns it may be said that Ambroise Paré was the first to give the proper value to cleanliness in the treatment of wounds, and while in many instances he blunders in his technic, yet such a course, free from the use of the thousand filthy applications which were common in his time, was a great step in the advancement of surgery.

Let us now turn from the list of anatomists and surgeons to the physiologists.

It is not my intention to deal with any history of the life of Michael Servetus. That has been done so much better than I can do it, that meddling in the matter by me is unnecessary.

Suffice it to say that he was in turn theologian, mathematician, astronomer, physician, religious controversialist, anatomist, physiologist, philosopher, printer, and apparently one who felt the urge to establish a new religious dogma. He was born in Spain, lived most of his life in France, and was finally, for his opinions, burnt at the stake by Calvin at Geneva. He has left behind in a hundred words in his book called "Christianismi Restitutio," a statement, clear and undeniable, of the course of the blood in the lungs, which was in his time an absolute denial of the theories of Galen, and which is a statement of the fact which could not have been made in fewer words. It is true that when he wrote this description he was engaged in an effort to prove his belief that the soul was located anatomically in the ventricles of the brain.

However silly we may reckon this effort to be in the light of our modern knowledge, we must recognize that Servetus was the first to conceive of and describe the true progress of the lesser circulation of the blood.

Immediately following the statement of Vesalius, denying the porosities in the interventricular septum, there arose throughout the medical world a keen effort to make clear the direction and process of the foetal circulation. Much that was written upon this subject was in an effort to find some ground upon which might be built a defense of the Galenical theory.

Carcanus (1537-1600) of Milan, a pupil of Fallopius, while recognizing that Galen had seen and described both the "foramen ovale" and the "ductus arteriorosus," was the first among the moderns to dissect and confirm the statement of Galen. Contemporaneous with Carcanus was Julius Caesar Arantius of Bologna (1530–1589); he seems to have been the most thorough of any of the physiologists examining the problem of the foetal circulation, and he was the first to demonstrate that there was no direct connection between the maternal and foetal blood current.

It is rather amusing to note that for a great many years the foramen ovale was called the "foramen of Botal" (born 1510, died circa 1580). It happened that in Botal's first dissection of the heart, he chanced upon the heart of an adult in which the foramen ovale was not closed. Botal was a Galenist and believed that by his dissection he had demonstrated the truth of the transudation of

the blood from the right to the left side of the heart as described by Galen. For many years the name of Botal gave a false impression in regard to anatomical knowledge of the foetal circulation, while Botal, a stubborn and pugnacius prototype of the Doctor Sangrado of Le Sage, did nothing in the modern world except by his teachings at Paris, to encourage the custom of bleeding almost to the point of exsanguination, for a period of over one hundred years. There were many other investigators of the foetal circulation, but the names that I have mentioned are enough; it need only be said that almost half a century after the establishment by Harvey of the facts in regard to the circulation, the controversy was still raging in Europe, and particularly in France, as to the functions of the foramen ovale and the ductus arteriosus.

I have already mentioned in this paper the two principal statements that had been made by Vesalius and by Michael Servetus; but in order to follow the progress of discovery in anatomy and physiology to its great climax, I must again refer to the fact that Vesalius had denied the porosities in the interventricular septum of the heart, that Michael Servetus had given a perfect description of the circulation of the blood in the lungs.

There can be but little doubt that the statement of Vesalius had had a marked effect upon the reasoning of two of the anatomists who were to follow him. If we are to believe many of the writers who have discussed the activities of Servetus, it is safe to doubt whether his statement in regard to the lesser circulation had ever caused any great commotion in the medical world of his time. Most of his books had been burnt and were not available for study by anatomists, and his career had been more that of an agitator in theological matters than along the lines of anatomical discovery. However this may be, we must recognize that, about fifteen years after the publication of Vesalius' work on anatomy, Matthew Realdus Columbus of Cremona, who had been a disciple and friend of Vesalius, published a work upon anatomy entitled "De Re Anatomica"; and in liber VII, in the chapter concerning the heart, Fol. 177, he gives a complete statement of the functions and physiology of the lesser circulation. In 1593, thirty years afterward, Andreas Caesalpinus of Arezzo also made a correct declaration and description of that circulation (Liber V of his Questionum Peripateticorum, Fol. 125, verso). Claim has been made by many people in Italy both for Columbus and for Caesalpinus as to the

discovery of the circulation of the blood. It will be readily seen that if any of the three men who announced the nature of the lesser circulation is to be credited with that discovery, it must be Servetus whose earliest announcement of his discovery is to be found in a manuscript now in the Bibliotheque Nationale in Paris, under date of 1546, and also in the printed copy of his Christianisi Restitutio of date 1553. This later copy was the property of Colladon, who was one of the legal representatives of Calvin at the time of the trial of Servetus, when he was condemned to death. The book shows the marks both of fire and of water, and for a long time it was supposed to be the only copy of Servetus' book that had survived the general destruction of his writings at the hands of religious fanatics. But there are a few other copies in existence, most of which are not of the original edition.

Columbus was an anatomist and surgeon, Caesalpinus was a botanist, and it is presumed that the latter's statement in regard to the lesser circulation was either inspired by the earlier description made by Columbus or that the development of his theory was by a process of reasoning based upon the analogy of the circulation of the sap in trees and plants.

I have already spoken of the description of the valves in the veins by Fabricius and have credited Caesalpinus with having first noticed the swelling of the veins distal to ligation of veins, or of other pressure.

Upon the foundation laid by Vesalius and the structure builded upon it by his followers was to be displayed that masterpiece of reasoning and experiment, that triumph of *reason* over *authority,* "The Discovery of the Circulation of the Blood by Harvey, in the Year 1613" [at St. Bartholomews Hospital in London]. In a period of less than sixty years medicine had made greater advances than had been made in that branch of knowledge since the beginning of recorded history.

I. DETERMINATION OF THE SPECIFIC PREVENTIVE IMMUNE BODIES PRODUCED IN THE BLOOD AS A RESULT OF PREVENTIVE TYPHOID AND PARATYPHOID-B INOCULATIONS
II. NOTES ON THE RELATION BETWEEN PREVENTIVE INOCULATIONS AND STATUS LYMPHATICUS[1]

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I

DETERMINATION OF THE SPECIFIC PREVENTIVE IMMUNE BODIES PRODUCED IN THE BLOOD AS A RESULT OF PREVENTIVE TYPHOID AND PARATYPHOID-B INOCULATIONS.

PROPHYLACTIC typhoid vaccinations produce in the blood the following antibodies: Agglutinins, bacteriolysins, opsonins and stimulins. W. Kolle (10, 12) studied bacteriolysins and agglutinins in some cases of typhoid inoculations. Shiga (13), V. Dungern and Cole (10) report one or two particular cases. The results systematically tested on the agglutinins are published in various references dealing with the vaccinations.

I tested the bacteriolysins principally, and, incidentally, the agglutinins. There are two methods of determining the lysins in blood, either by animal experimentation or in vitro. I preferred the first method, since it is much more dependable for testing the preventive value of the specific immune bodies. Guinea-pigs were the animals used. The experiments were made on thirty-five soldiers of the Japanese Third Imperial Guards Regiment in Tokio, and continued from December, 1916, to the next year, 1917. About nine hundred guinea-pigs were used for the tests.

The Vaccine Employed, the Method of Inoculations and of Taking the Blood to be Tested.—The vaccine with which the soldiers were inoculated had been prepared in the laboratory of our Army Medical School in Tokio according to the process described by Pfeiffer and Kolle. We had prepared two sorts of vaccine:

One c.c. of the first solution (fluid) contained 1.5 mg. of typhoid bacilli and 1.5 mg. of paratyphoid-B bacilli. One c.c. of the second

[1]Read at the 30th Annual Meeting of the Association of Military Surgeons of the U. S. Washington, D. C., October 12–14, 1922.

solution contained 2 mg. of typhoid bacilli and 2 mg. of paratyphoid-B bacilli.

All the bacilli had been killed by heating to 58° C. for one hour and then phenol (0.4 per cent) was added.

The injections were given subcutaneously over the breast at intervals of seven days. The number of the inoculations was three. The first dose consisted of 0.5 c.c. of the first solution, the second of 0.8 c.c. of the same solution, and the third dose of 0.8 c.c. of the second solution. The inoculations in our army are repeated every year. Therefore, in my series the recruits received the vaccinations for the first time, but the trained soldiers were reinoculated, because they had received the same inoculations the previous year.

The blood to be tested was drawn from the vena mediana into sterile tubes. The blood was taken three times; just before the first inoculation, on the seventh day after the second inoculation, and on the tenth day after the last inoculation. The blood drawn was allowed to clot spontaneously at room temperature, and the serum was then drawn off with a sterile pippette into sterile glass tubes. This serum was transferred to the laboratory to be tested.

The Method of the Tests.—Twenty-hour agar cultures of both strains, typhoid and paratyphoid-B bacilli, were used in all the following experiments:

At first the animal lethal dose of each strain was determined.

The typhoid strain (Komatsu) killed 200-g. guinea-pig in one or two days when 1/50 of a normal loop was injected into the peritoneal cavity as the minimal dose. The strain of paratyphoid B (Kodaka) could do this with 1/100 of a normal loop.

I used this minimal lethal dose three times as the test dose in testing the preventive immune bodies. The test dose of the culture was mixed with graded solutions of the serum to be tested, in 2 c.c. of the total volume. After being allowed to stand at room temperature for fifteen minutes, the bacillus serum mixture was injected intraperitoneally into guinea-pigs of about 200 g. The effective value of the serum was determined by whether the injected animal was unaffected or died in one or two days after the injection, while the control animal injected with the minimal lethal dose of the culture alone always died.

After some preliminary experiments, the following doses of the serum were used:

Before inoculations	*After inoculations*
0.1 c.c	0.001 c.c.
0.2 c.c.	0.00125 c.c.
0.5 c.c.	0.002 c.c.
	0.0025 c.c.

As to the agglutination tests, the serum was used in graded dilutions of 1 : 10 to 1 : 100 before the first inoculation, and 1 : 100 to 1 : 5,000 after the inoculations. One and a half mg. of the bacillus was mixed with each dilution of the serum. The serum bacillus mixture in 1 c.c. of the total volume was well shaken and incubated at 37° C. for two hours. Then it was allowed to stand at room temperature until the next morning, when the result was noticed and described.

RESULTS OF EXPERIMENTS

Tables I to IV show the results obtained in the series experiments.

SUMMARY

The specific protective antibodies and agglutinins in the blood serum of thirty-five soldiers were tested before and after the prophylactic typhoid and paratyphoid-B inoculations.

A review of the tables given brings out the facts:

Table I.—*Effect of Protective Antibodies in Sera of Recruits inoculated with Typhoid and Para-B Vaccine*

	Dose of serum necessary to protect animal from death, c.c.	Number of examined soldiers	Percentage
Before Vaccination:			
Typhoid bacilli	0.5	8	53
	More than 0.5	7	47
Para-B bacilli	0.5	2	20
	More than 0.5	8	80
On the 7th day after the second inoculation:			
Typhoid bacilli	0.00125	2	20
	0.0025	8	80
	More than 0.0025	...	...
Para-B bacilli	0.00125	1	11
	0.0025	5	56
	More than 0.0025	3	33
On the 10th day after the third inoculation:			
Typhoid bacilli	0.00125	12	67
	0.0025	6	33
	More than 0.0025	...	...
Para-B bacilli	0.00125	3	17
	0.0025	10	55
	More than 0.0025	5	28

1. Protective immune bodies which saved the animal from infection with the typhoid and paratyphoid-B bacilli appeared in the blood serum of those men who had been inoculated.

2. One-tenth c.c. of the blood serum of persons never vaccinated could not protect the animal against the lethal dose (3 x D.L.M.) of the typhoid and paratyphoid-B bacilli. A half c.c. of this normal serum protected only about 50 per cent from typhoid bacillus and 20 per cent from paratyphoid-B bacillus.

3. But 0.1 to 0.2 c.c. of the serum of those persons who had received the same inoculations one year before was able to protect the animal from typhoid and paratyphoid-B bacilli.

4. Two-thirds of the sera drawn on the tenth day after the last injection of the three repeated vaccinations of the mixed vaccine (3.55 mg. typhoid bacilli and 3.55 mg. paratyphoid-B bacilli in total) protected the animal from typhoid bacillus in 0.00125 c.c., other one-third of sera in 0.0025 c.c. In more than half of the eighteen cases examined the animal was protected from paratyphoid-B bacillus by 0.0025 c.c. of the serum.

TABLE II.—*Effect of Protective Immune Bodies in Sera of Trained Soldiers, Who Had Received the Same Inoculations the Previous Year.*

	Dose of serum necessary to protect animal from death, c.c.	Number of examined soldiers	Percentage
Before vaccination:			
Typhoid bacillus	0.1	12	67
	0.2	6	33
Para-B bacillus	0.1	13	72
	0.2	5	28
On the 7th day after the second inoculation:			
Typhoid bacillus	0.001	7	64
	0.002	2	18
	More than 0.002	2	18
Para-B bacillus	0.001	2	18
	0.002	7	64
	More than 0.002	2	18
On the 10th day after the last inoculation:			
Typhoid bacillus	0.001	10	83
	0.002	2	17
	More than 0.002	....	....
Para-B bacillus	0.001	8	67
	0.002	3	25
	More than 0.002	1	8

5. In nearly all cases, 0.001 to 0.002 c.c. of the sera of those men who had been inoculated the previous year and were reinoculated the next year with the same vaccine, were able to save the animals from death by infection of typhoid and paratyphoid-B bacilli.

As to Agglutinins

6. While all the sera of the recruits uninoculated agglutinated both bacilli in dilutions of 1 : 10 to 1 : 20, in nearly all cases the sera of the trained soldiers who had received the inoculation one year ago agglutinated both typhoid and paratyphoid-B bacilli in dilutions as strong as 1 : 50 to 1: 80.

7. After the three repeated vaccinations the sera of the recruits in large proportion agglutinated typhoid bacilli in dilutions of 1 : 400 to 1 : 800, paratyphoid-B bacilli in dilutions of 1 : 200 to 1 : 300, while the agglutination with the sera of the trained soldiers occurred usually in dilutions as strong as 1 : 600 to 1 : 1,000 against typhoid bacillus and dilutions as strong as 7 : 200 to 1 : 600 against paratyphoid-B bacillus.

TABLE III.—*Results of Agglutination Test with Sera of Recruits.*

	Dilution of serum	Number of examined soldiers	Percentage
Before vaccination:			
Typhoid bacillus..................	1 : 10	1	25
	1 : 20	3	75
Para-B bacillus....................	1 : 10	2	50
	1 : 20	2	50
On the 7th day after the second inoculation:			
Typhoid bacillus..................	1 : 100	1	10
	1 : 300	1	10
	1 : 400	4	40
	1 : 500	2	20
	1 : 600	2	20
Para-B bacillus....................	1 : 100	4	40
	1 : 200	1	10
	1 : 300	2	20
	1 : 400	2	20
	1 : 600	1	10
On the 10th day after the third inoculation:			
Typhoid bacillus..................	1 : 400	2	22
	1 : 500	1	11
	1 : 600	3	33
	1 : 800	2	22
	1 : 1,000	1	11
Para-B bacillus....................	1 : 200	4	44
	1 : 300	4	44
	1 : 800	1	11

DISCUSSION

Some observers, especially Gay (14), insist that the presence of antibodies against the typhoid bacillus is no certain indication of protection from infection with this microorganism. Thus it has been shown by Marx (15) that a technician who had been inoculated with the typhoid vaccine, and whose serum twelve days after the inoculation had the bacteriolysin titer as strong as 0.025, was three months later infected with the very culture that had been used to immunize him. Crombie (16) noted the occurrence of a case of typhoid fever in a physician who gave a positive Widal reaction fourteen days before he came down with the disease. A number of such observations have been noted by Ruediger and Hulbert (17) and by Trombridge, Finkle, and Barnard (18).

Gay and others (19, 20) believe that the typhoidin test has more

TABLE IV.—*Results of Agglutination Tests with Sera of Trained Soldiers.*

	Dilution of serum	Number of examined soldiers	Percentage
Before vaccination:			
Typhoid bacillus	1 : 30	1	7
	1 : 40	1	7
	1 : 50	2	13
	1 : 60	7	47
	1 : 80	4	27
Para-B bacillus	1 : 20	4	27
	1 : 30	7	47
	1 : 40	4	27
On the 7th day after the second vaccination:			
Typhoid bacillus	1 : 300	1	10
	1 : 400	1	10
	1 : 500	4	40
	1 : 600	1	10
	1 : 800	3	30
Para-B bacillus	1 : 100	4	57
	1 : 200	1	14
	1 : 300	1	14
	1 : 400	1	14
On the 10th day after the third vaccination:			
Typhoid bacillus	1 : 200	1	7
	1 : 400	1	7
	1 : 500	1	7
	1 : 600	6	40
	1 : 800	3	20
	1 : 1,000	2	13
	1 : 2,000	1	7
Para-B bacillus	1 : 200	4	27
	1 : 300	1	7
	1 : 400	4	27
	1 : 500	4	27
	1 : 600	2	13

distinct value than the mere determination of the antibodies in the circulating blood. But Nichols (21) regards the reaction not to be strictly specific in the sense that typhoid recoveries may also react to a solution of paratyphoid-A as well as to a solution of typhoidin. Thus he found in the case of individuals vaccinated against typhoid fever that 66 per cent reacted to paratyphoid-A and no more than 75 per cent reacted to typhoidin. It appears from the results of a work published by Gay and Lamb (22) that the reaction was positive in 75 per cent of typhoid recoveries and over 40 per cent among persons who had neither suffered from typhoid fever nor received the prophylactic vaccinations. Austrian and Bloomfield (24) obtained the same results in normal persons as in typhoid recoveries and typhoid vaccinated, although their results may be due to the fact that they used by far too large a dose of the typhoidin.

It would appear from these facts that the method obtaining this reaction must be improved in order that this reaction may be an exact measure of resistance against infection with typhoid and paratyphoid bacillus. Especially this typhoidin test seems to be inadequate to determine respectively the protective effect of the mixed vaccinations against typhoid and paratyphoid bacillus, because the reaction is not strictly specific.

Those authors who discuss the inadequacy of estimating the bacteriolysin titer as a measure of protection against infection with the microorganism often quote the case observed by Marx, in which the bacteriolysin titer was only 0.025 when it was tested twelve days after the vaccination. It is no wonder that the person who had obtained such artificial immunization came down with the disease as soon as his resistance was decreased by some unhygienic conditions and the virulence of the microorganism was strong enough. This case would give only an evidence that the artificial inoculation cannot absolutely protect against infection with the bacillus. Estimating the agglutinin in blood has but little significance in determining the specific protective immune bodies. I was unable to find any report showing that those who had given a sufficiently high degree of the bacteriolysin titer in the circulating blood suffered from the disease.

On the contrary, Stern (25) noted that the serum of a typhoid recovery was, even after several years, able to protect mice from death against the typhoid infection. The basis of the prophylactic immunity was the Pfeiffer's phenomenon, as well known, in which the serum of typhoid recoveries would protect animals from infection with the typhoid bacillus.

Kolle estimated the bacteriolysin titer in some cases of typhoid vaccinated. The results are as follows:

(*a*) One injection with 2 mg. of typhoid bacillus.

Bacteriolysin titer	*Case*
0.001	1
0.002	1
0.005	2
0.01	4

(*b*) Injected with 2 mg. of typhoid bacillus the first time and 4 mg. the second time.

Bacteriolysin titer	*Case*
0.001	3
0.002	2
0.005	2
0.01	1

The bacteriolysin titer was increased with each dose and seemed to accord with the real effect of the protection.

Therefore, to have the laboratory index of the degree and the duration of the immunity afforded by the inoculations, I preferred the serological method above described with animals, since this method could give relatively exact and specific results.

CONCLUSIONS

1. Some normal blood sera of human beings possessed a bacteridal property to protect guinea-pigs from death against the lethal dose of typhoid and paratyphoid-B bacilli in 0.5 c.c. Others needed more than 0.5 c.c.

The normal sera agglutinated both typhoid bacillus and paratyphoid-B bacillus in most cases in dilutions as strong as 1 : 10 to 1 : 20. This is due to normal agglutinin.

2. By three consecutive inoculations with 3.55 mg. in total of each of both bacilli typhi and paratyphi-B, the protective effect of the serum became in most cases about 400 times greater than that of the normal serum. But it must be noticed that some persons could not get such a high degree of immunity. The protective substances in their sera remained in a lower concentration, though the inoculation had been repeated.

The ratio of the amount of the normal agglutinins to that of the increased agglutinins in the serum after the three consecutive vaccinations was 1 : 20 to 1 : 40.

3. The serum drawn on the seventh day after the second inoculation contained already a tolerable amount of the protective antibodies.

4. The protective value of the serum is considerably decreased one

year after the inoculations, but it is yet about five times greater than that of the normal serum.

5. The reinoculations produce much more of the protective substances in the blood than the first inoculations. In other words, the vaccine stimulates the production of the protective antibodies. This relation is readily recognized when the results of inoculations of the recruits are compared with those of the trained soldiers.

6. The protective effect of the vaccinations against paratyphoid-B infections is a little less than against typhoid infection. But of course we must take into consideration the fact that the lower animals, such as guinea-pigs, are more susceptible to paratyphoid than to typhoid culture when such animals are used as indicators of the effect of the inoculations.

7. The clinical effect of the prophylactic vaccinations has been statistically indicated by the incidence of typhoid and paratyphoid fever among individuals protected in this manner. The best results have been obtained in the American Army (5) and the Japanese Army (12).

The laboratory index of the degree and the duration of the immunity produced as a result of the inoculations can be demonstrated by the tests in the manner previously described, though it is believed that there are some factors involved in the immunity not yet understood.

Lieut. Col. Masao Yagisawa, assistant professor of the Tokio Imperial University, kindly supervised my experiments.

The results of these experiments have been published in the Army Textbook of Preventive Medicine (12, page 122), in April, 1918.

REFERENCES

(1) Pfeiffer and Kolle: Deutsche med. Wochenschr., 1896, xxii, 735.

(2) Wright: Lancet, London, September 19, 1896, 807; Brit. Med. Jour., January 30, 1897, 16.

(3) Leishman, W. B.: Jour. Roy. Inst. Pub. Health, London, 1910, xviii, 394.

(4) Russell, F. F.: Jour. A. M. A., May 4, 1912, lviii, No. 18.

(5) Russell, F. F.: Jour. A. M. A., Aug. 30, 1913.

(6) Spooner: Transactions of Assn. of Amer. Physicians, 1912.

(7) Metschnikoff and Besredka: Ann. de l'Inst. Pasteur, December, 1911, xxv, 12, p. 865.

(8) Metschnikoff and Besredka: Ann. de l'Inst. Pasteur, March 25, 1911.

(9) Leishman: Jour. of Roy. Inst. of Pub. Health, xviii, Nos. 7, 8, and 9.

(10) Kolle and Wassermann: Handbuch der Path. Microorg., 1913, Bd. III, 2. Aufl.

(11) Emerson, H.: Arch. Inter. Med., 1914, xiii, 169, N. Y.

(12) Yagisawa, M.: "Gunjin Bōkigaku kyotei." The Japanese Army Textbook of Preventive Medicine, April, 1918.

(13) Shiga: Berl. kl. Wochenschr., 1904, Nr. 4.

(14) Gay, F. P.: Typhoid Fever Considered as a Problem of Scientific Medicine.

(15) Marx: Die Experimentelle Diagnostik, Serum therapie, and Prophylaxe der Infektionskr., Kapt. Typhus. Biblioth. v. Coler-v. Schjering, Berlin, 1902.

(16) Crombie: Some Statistics Regarding the Effect of Inoculation against Typhoid Fever in South Africa. Lancet, May 3, 1902.

(17) Ruediger and Hulbert: Is Dried Blood as Reliable as Fresh Serum in Making the Widal Test? Am. Jour. Pub. Health, 1914, iv. 113.

(18) Trombridge, Finkle, and Barnard: Report of a Typhoid Epidemic Occurring Three Months after the Use of Prophylactic Vaccine. Jour. Amer. Med. Assoc., 1915, lxiv, 728.

(19) Gay and Force: A Skin Reaction Indicative of Immunity against Typhoid Fever. Studies in typhoid immunization III. Arch. Inter. Med., 1914, xiii, 471.

(20) Gay and Claypole: Experimental Study of Methods of Prophylactic Immunization against Typhoid Fever. Studies in typhoid immunization V. Arch. Inter. Med., 1914, xiv, 671.

(21) Nichols: Observations on Antityphoid Vaccination. Jour. Exper. Med., 1915, xxii, 780.

(22) Gay and Lamb: The Application of the Typhoidin Test in a Group of Nurses and Physicians. Jour. Lab. and Clin. Med., 1917, ii, 217.

(23) Force and Stevens: Further Studies on Typhoidin. Arch. Inter. Med., 1917, xix, 440.

(24) Austrian and Bloomfield: The Typhoidin Reaction. Arch. Inter. Med., 1916, xvii, No. 5.

(25) Stern, R.: Ueber die wirkung des Menschlichen Blutserums auf die experimentelle Typhus infection. Ztschr. f. Hyg., 1844, xvi, 458.

Stern, R. and W. Korte: Ueber den nechweis der bakteriziden Reaktion in Blutserum der Typhuskranken. Berl. kl. Woch., 1904.

(26) Pfeiffer and Kolle: Uber die spezifischen Immunitats reaction der Typhusbacillen. Ztschr. f. Hyg., 1896, xxi, 203.

NOTES ON THE RELATIONS BETWEEN PREVENTIVE INOCULATIONS AND STATUS LYMPHATICUS.

The reactions of the prophylactic typhoid and paratyphoid inoculations are usually moderate and never serious. All the soldiers of the Japanese Army receive the inoculations every year. In most cases they react mildly. But the reactions of a very few soldiers are pretty severe. Though extremely seldom, the vaccination may involve even certain risks. Therefore, it is desirable to anticipate these individual differences or dispositions and thereby to differentiate the dose and the number of the inoculations, i.e., to individualize for the artificial immunization.

One of these individual differences is surely due to *Status lymphaticus* (11, 12). But an exact clinical diagnosis of *Status lymphaticus*, not post mortem, is not easily justified for the present. Haven Emerson (11), however, describes some practically important points for the clinical diagnosis of the *Status*.

I noted the relations between the *Status lymphaticus* as described by

him and preventive inoculations against the typhoid and paratyphoid-B bacilli. The observations were made on 629 men of the Third Imperial Guards Regiment in Tokio from 1916 to 1917.

The results are as follows:

CHART I.—*Status lymphaticus*

No.	*Signs of Status lymphaticus*	*No. of cases*	*Percentage of men examined*
1	Absence of hair on chin and upper lip	13	2.1
	Decided scantiness of hair on chin and upper lip	87	13.8
2	Absence of axillary hair	22	3.5
	Scantiness of axillary hair	70	11.1
	Absence of sternal hair	140	22.3
3	Absence of pubic hair	0	0
	Scantiness and feminine distribution of pubic hair	14	2.2
4	Slender thorax	5	0.8
5	Rounded contour of upper arms and thighs with an arching of the latter	39	6.2
6	Decided velvety skin	24	3.8
7	Undescended testicles	0	0
	Hypoplastic external genitalia, particularly with a small and pointed or acorn shaped glans penis	15	2.4
8	No Signs of Status lymphaticus	200	31.8
	Total	629	

Men exhibiting more than three of seven signs mentioned above, 119.

The feminine type of the pubic hair, according to Emerson, is "arranged transversely, and not rising toward the umbilicus, but ceases abruptly above the pubic region."

A. Relation of Status lymphaticus to the Character of the Reaction of Artificial Vaccination.

Among the 629 persons examined were 319 noncommissioned officers and trained soldiers, who had received the typhoid and paratyphoid inoculations in the previous year. The reactions of 26 men among these 319 had been noted as unusual and more severe than those of others. Seventeen persons (65 per cent) among these 26 had more than three signs of the *Status lymphaticus.* Three men who showed relatively serious reactions had the typical *Status lymphaticus* above described.

In consideration of these facts, the doses and the number of the inoculations were changed the next year for men of the *Status lymphaticus.* There were no means of knowing these individual differences for an exact comparison.

But 49 persons among 629 men inoculated had comparatively serious reactions. Eighteen soldiers among these 49 had been noted as *Status lymphaticus* cases. Especially *two* persons of these 18 cases had a typical *Status lymphaticus* and reacted seriously, though the dose of the

vaccine had been diminished to half of the common dose at the last injection.

B. Relation of the Status lymphaticus to the Protective Effect Produced by the Vaccinations.

I studied the protective substances in the sera of 35 soldiers vaccinated and have reported the results in a previous paper. There were three soldiers with typical signs of *Status lymphaticus* among those 35 men so examined.

The table on page 95 shows the relation between the prophylactic effect of their sera and the *Status lymphaticus:*

According to the preceding observations, though only a few cases were studied, it may be concluded that there are no remarkable differences between the *Status* cases and normal cases as to the production of the protective substances in their sera.

C. The Relation between the Status lymphaticus and the Occurrence of some Infectious Diseases.

The infectious diseases that occurred in the battalion, in which the preceding examinations had been carried out, were three cases of influenza and one case of *Meningitis epidemica* during the year. With the exception of one case of influenza all the cases occurred among men exhibiting signs of *Status lymphaticus.*

SUMMARY

1. One hundred and nineteen men (18.9 per cent) among 629 examined were noted as exhibiting signs of *Status lymphaticus* in accordance with the description by Emerson (11).

2. Seventeen soldiers (65 per cent) of those 26 who reacted comparatively seriously to artificial immunization against typhoid and paratyphoid-B bacillus in the previous year were found among the 119 *Status* cases.

3. The degree of the immunity produced in the blood of the three *Status* cases and 32 normal cases were tested. When the results of the *Status* cases were compared with the normal cases there were no remarkable differences between them.

4. One case of epidemic meningitis and three cases of influenza occurred in the battalion examined during the same year in which the tests were made. Except one case of influenza all the cases occurred among the men who had been noted as of the *Status lymphaticus.*

DISCUSSION

Emerson reports that individuals of the *Status lymphaticus* are more susceptible to the danger of infectious diseases than are normal people. The prognosis, when they are infected, is more serious than for normal

CHART 2.—*Relation Between Status Lymphaticus and Prophylactic Inoculation*

Name of soldier	Trained soldier or recruit	Signs of *Status lymphaticus*	Reaction following inoculation	Protective antibodies before vaccination: Dose of serum necessary to protect guinea-pigs against bacillus		Protective immune bodies after three inoculations: Dose of serum necessary to protect guinea-pigs against bacillus	
				Typhi	Paratyphi-B	Typhi	Paratyphi-B
Y. N.	Recruit	Scanty beard, scantiness of axillary hair, absence of sternal hair, pubic hair arranged according to feminine type, small penis and acorn-shaped glans penis.	Maximal body temperature 38.3 C.	0.5 c.c.	More than 0.5 c.c.	0.00125 c.c.	0.0025 c.c.
K. Ik.	Trained soldier	Absence of sternal hair, pubic hair arranged in feminine type, rounded upper arms and thighs, delicate skin, small penis, cervical and axillary lymph nodes a little palpable.	Maximal fever, 39.4° C. Severe headache and malaise.	0.1 c.c.	0.1 c.c.	0.001 c.c.	0.001 c.c.
K. Ish.	Trained soldier	Scantiness of hair on chin and upper lip, scanty sternal hair, pubic hair in feminine distribution, upper arms and thighs round and glans penis pointed.	Diarrhea and malaise and pains on limbs	0.1 c.c.	0.1 c.c.	0.001 c.c.	0.001 c.c.
T. Momma	Trained soldier	No sign particularly noted.	No particular symptom.	0.2 c.c.	0.2 c.c.	0.001 c.c.	0.001 c.c.
T. Hattori	Trained soldier	No particular sign.	No particular symptom.	0.2 c.c.	0.2 c.c.	0.001 c.c.	0.001 c.c.
S. Matsumoto	Trained soldier	No particular sign.	Diarrhea, headache, malaise.	More than 0.5 c.c.	....	0.0025 c.c.	0.0025 c.c.

(1) The latter three cases have been described as the controls.

(2) The trained soldiers were reinoculated; they had received the same mixed vaccinations in the previous year. **The recruits received the inoculations for the first time.**

men. Therefore, it is of practical importance in preventive medicine to avoid possible infection by such precaution as artificial immunization against typhoid and paratyphoid fever and *Meningitis epidemica.* At the same time it is our evident duty to decrease uncomfortable and serious reactions for such men.

CONCLUSIONS

There are certain relations between preventive inoculations and the *Status lymphaticus* as described by Emerson.

For such people we should use particular care to avoid the danger of unfortunate accidents.

It is desirable to pay heed to cases of *Status lymphaticus* before the vaccinations.

In such persons inoculations should be made with all precautions.

When such men have been inoculated, the effect of the preventive vaccinations does not seem to be different from that in the normal cases.

I wish to express my sincere thanks to Col. K. Saisawa, professor at the Tokyo Imperial University, under whose direction I did this work, and also to Lieut. Col. K. Tsubota, Capt. K. Hanasawa, and Lieutenants Kimura and Inamura, for their kindness in helping me to examine the soldiers in the Third Imperial Guards Regiment.

REMINISCENCE OF THE BATTLE OF BORODINO, 1812

By W. W. KEEN, M.D.

Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia

I WAS at this battle 110 years ago (by proxy) in the person of a French soldier. He received a bullet wound in the calf of the leg. He escaped capture. The wound healed soundly, and for years, while he knew that the bullet was there because it had never emerged, he was not aware of its presence by reason of any inconvenience from it.

Finally, fifty years after the receipt of the wound, his leg began to pain him, then the spot grew tender and red, and later the skin ruptured.

He was living in Philadelphia with his daughter and, obtaining a woman's weapon—a hairpin—one day he pried out the bullet from the old wound. But the wound did not heal. It still continued to discharge and was quite painful. Accordingly, he summoned my old professor of surgery, Prof. Samuel D. Gross, who took me with him in his carriage to the northeastern part of the city where we found this fine old fellow, straight and erect as a ramrod.

After taking his instruments from their velvet-lined, dust-carrying case, and laying them on the table, Gross turned to the patient and said, "If you will please now lie down on the couch yonder, my young friend Keen will give you some chloroform." The old soldier straightened himself up and said proudly, "Do you suppose a soldier of the First Napoleon wants any chloroform?" and thrusting out his leg, he exclaimed, "Go ahead." Dr. Gross obeyed this injunction and went ahead.

The incision revealed a hard substance which, on removal, proved to be a cup of bone which had formed as a result of the irritation of half a century by the presence of the bullet and the constant friction of the muscles of the calf of the leg. After the removal of this, the wound soon healed.

During this operation, the old man might just as well have been a cadaver so far as any manifestation of pain, or any movement of the leg, was concerned. I feel very proud of my proxy.

THE FLEET SURGEON—SOME THOUGHTS ON HIS OFFICIAL RELATIONSHIP AND OPPORTUNITIES FOR USEFUL SERVICE

By Captain WM. H. BELL
Medical Corps, United States Navy

THE Office of the Fleet Surgeon has been discussed much and to excellent purpose in splendid papers by well-known representatives of the Naval Medical Corps. There would seem little if anything more to say in exposition of its functions. And yet the world moves, points of view change, and late incumbents may be entitled to a hearing on the chance that their conception of opportunities for usefulness in the office may have a place in its development and merit perpetuation in the continuity of service contemplated by Carpenter in the last sentence of his paper entitled "A Greater Field of Activity for the Fleet Surgeon,"[2] in which he says:

> Finally, in the Fleet Surgeon's Office should be kept a systematized and careful file of all sanitary bulletins, recommendations, suggestions, tentative plans for battle and landing force, reports and returns, etc., in order that the work of one man may be available for his successor and the field of activity of the fleet surgeon made subject to a progressive growth year by year.

As far as I am able to learn this is the latest of a series of papers or discussions on the subject by Beyer, Curtis, McCormick, Dunbar, Blackwood and others. Each of these officers contributed something new, and Carpenter has brought their ideas together in a review of the possibilities of the office and has advanced its usefulness and importance by suggestions of his own.

As the title indicates him to be the integrating officer of the medical activities of the fleet, it is natural and entirely proper to stress those factors of the duty involved which most obviously make for the paramount consideration of military efficiency. Not only do the articles or discussions of those above mentioned do this more or less thoroughly, but much, if not quite all, that they expressed as necessary to the dignity, latitude and effectiveness of the office has been realized in practice. I find no fault with the emphasis laid upon the purely medico-military responsibility and duty of the fleet surgeon, or those elements which others have believed to be concerned as components of this phase of

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[1]Read by title at the 30th Annual Meeting of The Association of Military Surgeons of the U. S., Washington, D. C., October 12-14, 1922.

[2]The Military Surgeon, February, 1916.

his duties. I subscribe to them all and merely mention their full presentation as reason for avoiding their considerations here.

It will suffice to enumerate them briefly as follows: To keep himself informed and advise the Commander-in-Chief concerning the condition and efficiency of the Medical Departments and sanitary conditions and health of the fleet; to watch disease movements in the fleet with a view to control or timely action in the interest of preventing or checking epidemics; to keep in touch with health conditions and disease movements and those activities and public services in civil communities at, or adjacent to, bases or ports visited which bear upon the health of the fleet with a view to its protection; to study the provisions for and methods of handling the sick and injured with a view to promoting their comfort and effective management; to investigate and advise concerning the conduct of medical departments of ships and their organization for war and other emergencies with a view to standardization and complete preparedness; to formulate tentative plans for the care and evacuation of the sick and wounded in fleet action and land operations; to acquaint himself with the capabilities and needs of the different medical and dental officers; and to determine and arrange that the supplies, both reserve and moving, are adequate and economically used —in short, to supervise the administration of the medical department of the fleet in connection with all its actual and possible activities and concern himself constructively with those factors entering into the morale of the medical department personnel.

Not only am I cognizant of the importance of what others have said; not only am I striving to perform all the duties that have been asserted by them and accepted as legitimately attaching to the office, but I am the grateful beneficiary of the accomplishments of my predecessors toward increasing its importance and enlarging its opportunities. The increased dignity of office, latitude of service and effectiveness of effort which I am enjoying are not due to any fundamental change in regulations concerning the fleet surgeon but to the ability, vision and tact of those who have served as such and to the confidence which they have inspired in the particular Commander-in-Chief of whose staff each was a member. The experience and training and capabilities necessary to fit an officer for the duties of fleet surgeon are suggested by the foregoing enumeration and have also been discussed by Beyer, Blackwood, Carpenter and others. It would seem that a course at the War College is at least desirable, and a breadth of vision is important.

The importance of personality cannot be over-estimated, but it would seem that practical recognition of this consideration is sufficiently

insured by the manner of selecting the fleet surgeon. The regulations require that: "A Commander-in-Chief ordered to command a fleet will recommend to the department the composition of his proposed staff." The fleet surgeon, by virtue of this provision, should be *persona grata* to the Commander-in-Chief. He is of course a representative of the Bureau of Medicine and Surgery, in so far as he is usually a ranking member of the Medical Department, and by virtue of his ability, training and presumable familiarity with the general policy and desires of the bureau, but only so far and not officially, in the sense that his first loyalty and primary duty is in that direction. Theoretically, at least, every Commander-in-Chief is desirous of ordering the medical activities in the fleet conformably with what study and experience under the trained observation of the bureau has been determined to be best, as far as this may comport with military necessities, and the fleet surgeon is existent to advise him not only as to these and concerning matters involving the health of the fleet but technically in unforeseen occurrences.

In that large field of opportunity, open to each staff officer, touching the vital question of developed and maintained efficiency the peculiar ideas of the particular Commander-in-Chief are and must be the guide. The fleet surgeon, like all other staff officers, is the selection of the Commander-in-Chief under whom he is serving. No office in the service therefore could be more personal and, as an inspecting officer, in all that he may do, either directly or indirectly, in the interest of medical department efficiency and the physical fitness of the personnel of the fleet, the fleet surgeon is the immediate representative of the Commander-in-Chief.

The means to possible benefits or details of all that may be necessary or helpful in the building-up process along these broad lines are for the fleet surgeon to suggest or work out, but his initiative, conceptions, solutions and proposed acts remain subject to the approval of the Commander-in-Chief and will be judged according to their faithfulness to the big end in view—the preparedness of the fleet in spirit and training and the physical fitness of matériel and personnel for highest efficiency in the engagements both of peace and war.

Do not read into the foregoing any misunderstanding of the initiative and latitude permitted the fleet surgeon. He is not necessarily restricted in either because of the stipulated first required obligation of loyalty to his immediate chief. His area of discretion is not curtailed so long as he is faithful to its proper limitations, the right to act and exercise judgment within the range of loyalty to the policy and plans and particular point of view with regard to the command of the Commander-in-Chief with whom he is identified. It is manifest that the

Commander-in-Chief cannot himself do all in every special direction that he desires accomplished, nor can he for various obvious reasons even give detailed constructive thought to the manifold activities and possibilities involved in the big undertaking of developing and maintaining the fleet's efficiency. This is the work which devolves upon the members of his staff and in the execution of which he is ever ready to consider their ideas and suggestions in connection with his own as to the means of effecting progress in their individual fields of delegated supervision, to the end that each separate though coordinated activity entering into the composition and work of the fleet may deliver its full expected quota to the attainment of highest standard of readiness in personnel and matériel of the fleet as a whole.

In the duties thus broadly indicated, as well as in the spirit of their performance, the fleet surgeon should feel and act under the obligation to try to discern and carry out the ideas and wishes, in addition to the specific directions, of the Commander-in-Chief; to try, as his representative in relation to all medical department matters and those effecting its morale, to perceive what he might do under existing circumstances if acting directly and to be guided accordingly.

This does not mean that the individuality of the fleet surgeon has no place in the scheme of things. There is need for it; otherwise he would not have been selected to serve, and a large part of his value to the Commander-in-Chief is in the acuteness of his observance of opportunities and recognition of needs and initiative in suggesting ways for improving everything which fairly promises to increase the efficiency of the Medical Department both as regards professional capabilities and morale. Moreover, it is the large results which the Commander-in-Chief is looking for and the manner of securing them is, as in the case of other staff officers, a matter of personal discretion.

The broad view of what may be to the welfare of the command is that which the fleet surgeon should always try to use as his guide to proper service as a member of the staff, and by the same token he should never consciously ask the Commander-in-Chief to give official thought to any matter lacking that legitimate foundation or that is personal in the sense of being selfishly restricted in purpose.

The laws and regulations and instructions relative to the office of fleet surgeon are not very specific or comprehensive, but it is believed that they are in no sense restrictive, and experience has demonstrated that they "admit of almost any innovation within the scope of medical department activity, calculated to enhance its usefulness as a coordinate branch of the Navy." It is this welcome fact which gives latitude for the exercise of imagination in service and which in the Pacific Fleet

during the past year has been partly employed in the interest of closer contact between the medical officers afloat and the professional thought and work at army and navy hospitals and of the medical fraternity of each of the large port cities visited.

It is submitted that the professional efficiency of medical officers and, in consequence and as a direct result, the efficiency of the Medical Department in professional services to the personnel of the Navy, is enhanced by and in proportion to opportunities for medical observation and experience. It is a recognized fact in contrast to line officers that, in a strictly professional sense, duty at sea on other than hospital ships tends to become a period of relative professional stagnation for medical officers, and anything which will operate to counteract or minimize such a tendency should be encouraged in the interest both of the medical officers themselves and those dependent upon them.

The duties and observations and experiences of medical officers at sea are of course very important and serious, and no disposition to underrate this phase of the naval medical career is entertained, but they are largely in the direction of medico-military development and sufficiently at the expense of development in medicine and surgery and their specialties to justify the expression, "a period of relative professional stagnation," which I have applied to sea duty.

Again in contrast to the line officer, who is generally given a definite duty upon which he can for the time being concentrate attention, a medical officer at sea, particularly when remote from hospital facilities and denied access to the benefits of consultation, is under the peculiar necessity of being all things at all times, as far as it is humanly and physically possible for him to be so in these days of specialization and high development in every direction. He must be prepared to treat or operate upon any one of the conceivable acute or chronic conditions that may arise among even such an apparently healthy lot as a picked ship's company, as well as to attend to his other manifold ship's duties. But his ability to properly and adequately care for the sick and injured is, after all, the touch-stone of his ability as a medical officer, particular though the requirements and his effectiveness in other directions may be, and opportunities to strengthen his hand for the best service under the circumstances, no matter what the demand, should not be overlooked or neglected.

As intimated above, there is much in service afloat, in all but hospital ships, which is highly important and legitimately preoccupying at the expense of the strictly and narrowly professional, but the sea is the paramount field of naval activity to which all other naval activities are merely contributory, and it is there that medical officers as well as

those of other branches of the service learn the breadth and focus of their responsibilities. Numerous and diversified as the medico-military duties are, their efficient performance is as dependent upon a fundamental professional competence as the science of navigation or gunnery upon mathematics, and the need to keep abreast of the times is therefore insistent. This is a consideration quite aside from the fact that, if one does not keep in touch with medical progress and hold his professional sense and abilities alert, against the opportunity for their pointed exercise, he will certainly fall hopelessly behind.

Are not these thoughts enough to suggest a profitable line of endeavor to the fleet surgeon, whose Commander-in-Chief is broadly comprehensive in his recognition of the components of efficiency in the units and individual ships and individuals of his command and who is open to every suggestion promising to further it. Moreover, every commanding officer is alive to the fact that the professional development of his medical officer will add to the strength, comfort and morale of his ship in assured ability to care for the emergencies that arise, and that every act in the furtherance of opportunities in this direction will be an investment which will return a royal interest.

By what means may the fleet surgeon organize the resources which offer promise of meeting the indicated needs? Surely the liberal interpretation of the function of his office makes it the fleet surgeon's duty to survey the field and not only present full information as to the medical interests available to medical officers of the fleet but pave the way both in the centers of medical activity ashore and with the powers that be in the fleet that fullest advantage may be taken of them. There is no other direction in which the Dotheboy's Hall method of Dickens' *Squeers* is more applicable. Having spelled the need, it becomes the fleet surgeon's duty to execute the task it embodies. His strategic position makes it easy and also emphasizes the obligation, for his rank and office facilitate the arrangements and stimulate the hospitality which he seeks to create in behalf of the medical officers of the fleet, and his assumption of the obligation conduces to economy of effort. Think what it would mean if to a representative of each ship was left the intricate survey of the varied medical interests in each community visited. The medical officers of the fleet have a right to look to the fleet surgeon for such information in detail and to expect to be relieved of the otherwise time-consuming necessity for each one to duplicate the search.

The interests and facilities which should be brought within their convenient reach with a statement of the nature, place and hours available, should embrace hospital and dispensary clinics, X-ray and

clinical laboratories, special courses, general medical conferences, hospital ward classes, hospital staff meetings, medical society meetings, medical university extension courses and medical libraries, etc. Not only should each ship be supplied with the most complete data along the lines above indicated, including names, addresses, telephone numbers, car routes to be taken and time required to reach specific destinations in order that the limited leisure of a given officer may be employed to best advantage, but these data, when concerning a topic subject to change, should be kept up to date and the medical officers of each ship kept in touch with local current events or developments through the medium of fleet letters or bulletins.

Unfortunately from the point of view of the fleet's advantage, much and often the best of what is of general interest in the activities of hospitals and other medical institutions occurs during the morning hours when the medical officers of ships are also most closely engaged. Special clinics at convenient hours can be and are arranged by the government hospitals, but the benefit of offerings by civil hospitals can be taken advantage of only through the understanding and sympathetic disposition of commanding officers. Such an attitude of mind if not already existent is easily brought about, for, as a rule, it is only necessary to invite notice of the facts, and the Commander-in-Chief's announced favorable view of the matter gives it official sanction. A paragraph in the Fleet Regulations to the effect that "The attendance of medical officers upon clinics and other similar activities at ports which offer the benefit of such opportunities for professional instruction and improvement, should be facilitated as far as may be consistent with service requirements" is sufficient.

Of course, when target practice and other important drills concerned with battle efficiency are being carried on, medical officers must be on board ship, but it is believed that for the purpose in mind, at times of relative freedom from drills, such as when ships are at navy yards or in ports for periods of overhaul and recreation, one medical officer could satisfactorily attend to the routine morning duties of the medical department and the other, alternately, could be excused from quarters to attend the scheduled clinics and other medical activities either ashore or on the hospital ship. This employment of the morning hours by the officer excused should properly be regarded as a matter of official duty, and all interest or enthusiasm in the opportunities thus afforded, or the lack of it, should be noted and taken into account in estimating the officer's fitness.

There are many other directions in which the fleet surgeon may exercise his vision and ingenuity to the credit of progress and highest

attainments. They will suggest themselves to the alert and observing officer. Among them are periodic conferences of medical and dental officers with the fleet surgeon, intership visiting and the *Fleet Medical Bulletin*. All of these are agencies which assist closer acquaintanceship, better mutual understanding, more effective cooperation and standardization along the surest and best lines.

General medical conferences are impossible at regular intervals because of drills of one kind or other, the movements of ships and other reasons, but they should be convoked on the average of about once a month—not more often lest the virtue of them be lost in a feeling that they are irksome. They can be held on the flagship of the Commander-in-Chief or the hospital ship, preferably the latter, where the professional atmosphere is more favorable to the results in view. Special conferences with the senior medical officers of ships on definite problems may be called whenever desirable, and these can be made brief and to the point. It should be the aim to make the general conferences only sufficiently formal in character to accomplish the business in hand and without interfering with the ease and cordiality of association and the freedom of discussion which are necessary to the agreeableness of the occasions and the best development of the subjects presented for consideration.

The fleet surgeon should avail himself of these occasions to communicate accumulated information of interest to the officers and which, because of its semi-confidential nature or otherwise, does not reach them in any other way, and to express his views concerning matters of general medical department policy and administration which have engaged his thoughts as reflections of the wishes of the Commander-in-Chief or the Bureau of Medicine and Surgery.

In advance of the conferences certain subjects of special importance should be announced for consideration. This should not be for the purpose of the preparation of formal papers but with the idea that each medical officer may give such thought to, or make such study of, the subjects as will serve to fit him for an intelligent part in the discussions. As a feature of the conferences, also, the officers of the hospital ship should present cases and laboratory or X-ray findings which are of special interest and give everybody, particularly those of the ships from which cases were sent, an opportunity to benefit by their observation and studies of those cases.

The personal contact between officers of the Medical Corps incident to these gatherings, and the opportunity which they afford to learn one another's peculiar problems and freely discuss those common to all with standardization of practice in view, give them great value in building up efficiency.

The question of intership visiting on the part of medical officers as a matter worthy of notice and encouragement by the fleet surgeon is not given its due. As regards general ships' duties and preparations for the various emergencies incident to sea service, those who do not take or make opportunity to visit other ships and see how other medical departments are equipped and conducted neglect valuable sources of helpful information. There should be more of such exchange of visits in the interests of refreshing one's point of view and picking up ideas which will lend themselves to improvement in one's own field of enterprise and responsibility. The fleet surgeon therefore should stimulate this interchange and, with a view to the benefit that is sure to be derived from intership visiting, he should ask for the association of the senior medical officers of one division of battleships when inspecting the medical departments of another division.

The monthly *Fleet Medical Bulletin* serves the helpful purpose of disseminating important information and constructive thoughts on medical department concerns, in addition to statistical data, which could not be effectively presented any other way. It is the medium for "sailing directions," which can't be left to the mischance of word of mouth communications, and it should be made the most of as such. Guidance is needed in many directions not covered by existing publications, and timely comments will not only save many from misstep but lead them to fuller and better effort.

Another matter coming within the purview of the fleet surgeon and with which he should concern himself in the interest of the morale of the fleet is medical provision to meet the needs of the families of the officers and men. This may seem extraneous, but the communities in the neighborhood of the fleet bases nowadays (with the official sanction and action of the Navy Department) constitute the temporary homes of such families, and their male members in the fleet are not only duly solicitous but immediately concerned in their welfare. Whenever officers and men are away owing to the movements of ships, this fact becomes emphasized and suggests the desirability, if not the importance, of placing such information in the hands of naval families as will tell them precisely where service medical attention is to be had and, in emergencies or during the absence of the fleet, guide them to the most reliable civilian doctors and the most suitable hospital, etc. The data accumulated and distributed should be as comprehensive as a visualization of the ordinary needs and possible emergencies could indicate.

When all is said, the acme of the fleet surgeon's duty is inspection, either direct or indirect, and the conception of the function and the manner of its performance very largely determine the success of the

office. In this he should have the association of the Senior Dental Officer of the Fleet, or the Dental Officer of the Commander-in-Chief's Flagship, for there are many technical matters in dental activities which can be properly estimated and judged in this way only, and the importance of dental fitness to general physical fitness needs no argument. The Inspection Report Form (questionnaire) in its fulness, which is to guide the Fleet Surgeon in his inspections, should be familiar to the medical and dental officers of individual ships or units of command, as an exhibit of what is expected of them, so that they may not be surprised by the line of inquiry pursued. It is efficiency that the Commander-in-Chief is driving for and, if the Inspection Report form comprehensively indicates (it should as far as possible) the features of concern considered to enter into the attainment of the desired standard, the reason for giving it publicity long in advance of inspection becomes clear. The aim should be to produce improvement in conditions found pressures, high and low diastolic pressures, large and small pulse pressures, rapid and slow pulse rates and cases of systolic pressure rise and office. The aim should be to produce improvement in conditions found unsatisfactory or maintain a satisfactory standard already attained. The principle of helpfulness is the key-note, and by just the degree with which it is observed will the fleet surgeon assist within his legitimate range of influence, to the desirable state in the consciousness of subordinates of a feeling of closeness to their Commander-in-Chief.

COMMENT AND CRITICISM

AN APPRECIATION FROM SURGEON REAR ADMIRAL C. MARSH BEADNELL, ROYAL NAVY

November 22, 1922.

c/o Admiralty,
Whitehall, London, England.

To: Captain Frank L. Pleadwell, M.C., U.S.N.
President of the Association of Military
Surgeons of the United States held at Washington, D. C.
October 12–14, 1922.
Navy Department,
Washington, D. C.
United States of America.

DEAR CAPTAIN PLEADWELL:

Now that my extremely interesting and instructive visit to Washington, as representative of the Medical Services of the Navy and Army of Great Britain at your recent meeting of the Association of Military Surgeons of the United States, is over, it becomes a pleasant duty to thank you, Sir, as President of the Association, firstly on behalf of the two Services I have had the honour to represent, for your courtesy in inviting a delegate from the Mother Country, and secondly, for myself, for the exceedingly hospitable manner in which you have received and entertained that delegate.

There were many features in connection with your Congress that impressed me forcibly. First and foremost was the captivating way in which your several papers were written and organised. While individually exhibiting the keen specialisation of the author in his particular subject, they were, nevertheless, so composed that every member of the audience, whether or not he had himself specialised in the subject-matter of the papers, could yet follow them with advantage, and this fact was enhanced by the great breadth and scope allowed the authors of papers in the selection of their subjects for study and discussion. Further, I was impressed with the fact that these annual meetings afforded a most beneficial means of intercommunication between your several medical Services, especially between those of your Army and Navy. They tended towards greater coordination while at the same time they encouraged that healthy pride and *esprit de corps* which each individual should have in his own branch, all of which makes for greater efficiency of the fighting machine as a whole. Lastly, such meetings possessed self-evident international value, for your hospitality was the means of bringing together in a spirit of comradeship medical officers of diverse nations.

Although this is your thirtieth annual meeting, yet it is, I believe, the first you have held after the Great War, and as I am the first British representative to attend since those terrible times of stress and trial perhaps it will not be unfitting to say here a word thereon. Much water has flowed under the bridges since the Old Pilgrim Fathers first laid down the transpontine cables of affection linking up the two sister

countries. Indicative of our relatively recent common ancestry of body, mind and speech and, consequently of a parallelism of ideals, those bonds, linking up the two lands have been reforged and retempered in the furnaces of the Great War, and their strength now is such that their rupture is as inconceivable as a square triangle or a stick with one end. Early in that war, when we were sorely pressed for doctors, you eagerly came to the help of the sick and wounded, and in that act you impressed an eregram on the cerebral neurons of your Alma Mater that will last until humanity is extinct.

I shall always look back with enjoyment to my recent visit to the States. It was not only an honour but a real pleasure to have been present at your Congress and especially was it so to me, for, although it was my first visit to America, it was the second occasion on which I have had intimate association with your naval and military medical officers, and it is significant that each of these associations was, for me, a momentous occasion. It was in 1898–1899 when your country was at war with the Filipinos, and I was a young surgeon in Her Majesty's ship *Powerful*, then at Manila, that I first had the pleasure of meeting your naval and military officers. At that time you were not suffering from a redundancy of medical men at the front and in consequence—to make a long story short—I found myself landed with your forces and entrenched in the front line—then at Caloocan—under General Lloyd Wheaton. I was in that memorable advance from Caloocan to Malinta when you swept the Filipinos in front of you and Aguinaldo had to fly to the hills for reinforcements of Igorotos. I worked with Major Shiels in the field and was with Colonel Egbert when he was killed. Later I worked at the base under Major Fitzgerald, the Senior Operating Surgeon of the First Reserve Hospital at Manila. Thus it was with Americans that I received my baptismal fire and was initiated into the mysteries of field ambulance work. It was your military surgeons who first impressed me with the fact that the mentality of the medical man on active service is something unique in itself. In the din and heat of battle, when passions rage, and the primal instincts of nature, red in tooth and claw of necessity, well up to the surface in the fighting man I had my first spectacle of the Field Surgeon on active service. I saw him, in an environment of dead and dying friends and foes, with shell shrieking overhead and bullets ripping up the ground around him, his mind soaring dispassionately far above the general clamour in the cool serene atmosphere of science and art as, quietly, quickly and unostentatiously he carried out his duties of succouring the wounded and alleviating their pain and anguish. The little, semi-nude Filipino, trembling with fright through expectation of some horrible form of torture, was dealt with as gently and skilfully as the wounded American soldier. It was from your surgeons I first had practical demonstration of that great ethical principle which underlies the profession of medicine the wide world over. To peer or commoner, to plutocrat or pauper, to saint or sinner, the doctor, on any and every occasion, gives of his best—to him a sick man is a sick man, and that is the Alpha and Omega of his whole training and practice.

In conclusion, Mr. President, permit me once more to thank you for all your kindness to me while attending your Congress. I have also

to thank you for conferring on me the honour of Life-Membership of the Association of Military Surgeons of the United States. . . .

With my best regards to you and all, and hoping your future Congresses will be the successes this one was, I remain,

Yours sincerely,

C. MARSH BEADNELL,
(*Surgeon Rear Admiral*), *Royal Navy.*

NATIONAL BOARD OF MEDICAL EXAMINERS

The National Board of Medical Examiners announces the following dates for its next examinations: Part I—February 12, 13 and 14, 1923. Part II—February 15 and 16, 1923.

The fees for these examinations have been continued at the reduced rate for another year. Applications for these examinations must be forwarded not later than January 1, 1923. Application blanks and circulars of information may be obtained from the Secretary of the National Board, Dr. J. S. Rodman, Medical Arts Building, Philadelphia, Pa.

SECOND INTERNATIONAL MILITARY MEDICAL AND PHARMACAL MEETING

Rome, 28th May to 2nd June, 1923

The Second International Military and Pharmacal meeting will take place in Rome, Italy, from the 28th of May until the 2nd of June, 1923.

The first one was held in Brussels, Belgium, in July, 1921, and there were present representatives of 19 nations.

The following subjects will be discussed at the second meeting:

I. Evacuation.

1. General principles of evacuation from the armies in the field.
2. Organization of evacuation bearing in mind the limitations imposed by the conditions of the patients.
3. Adaptation of medical and surgical methods of treatment in accordance with the varying conditions imposed by the necessity of evacuation.

Presented by delegates from Italy and France.

II. Cooperation between the civil and military authorities in questions of social hygiene, physical training and prevention of disease.

1. Statistical considerations of disease—tuberculosis, venereal disease, alcoholism, mental defects—the diagnosis of such cases and measures of prevention.

Presented by delegates from Italy and discussion by English and American delegates.

III. A critical study of the methods of disinfection and disintectation in both peace and war.

Presented by delegates from Italy, Spain and Switzerland.

IV. The treatment of penetrating wounds of the chest and of their sequelae.

Presented by delegates from Italy and Serbia.

Pharmacy: Clinical laboratories in the field; their role and the methods employed.

Presented by delegates from Italy and Checo-Slovaquia.

For each subject an official delegate will be appointed by Italy and another by the nation or collaboration of nations indicated beside every one.

The quota of inscription to the meeting is fixed at 25 francs for the members of the Congress and 15 francs for their families.

The official organ of the meeting is the *Giornale di Medicina Militare* (Roma—via XX Septembre—Palazzo del Ministero della Guerra) to which persons interested can apply for information concerning the meeting.

POST GRADUATE SCHOOLS FOR VETERANS' BUREAU PHYSICIANS

In order to render the best possible professional care and treatment to disabled ex-service men, Col. C. R. Forbes, Director of the Veterans' Bureau, announces that he is about to establish Post-Graduate Schools for physicians now connected with the bureau and those who wish to join this service.

There will be two schools for the teaching of the diagnosis, care and treatment of pulmonary tuberculosis, one at Fitzsimons General Hospital, Denver, Colo., and the other at U. S. Veterans' Hospital No. 41, New Haven, Conn. The courses at these hospitals will be uniform and will run simultaneously. Each course will last two months and will include collateral branches of medicine such as pathology, X-ray plate interpretation, physiotherapy, etc.

Before attending the schools physicians now in the service will be given a preliminary course which will be established under competent instructors in each of the veterans' hospitals for tuberculosis. They will then be selected to take the post-graduate course at Fitzsimons or New Haven. Specialists not connected with the bureau will be invited to attend and give lectures to the students. It is anticipated that at least three courses of two months' duration each can be run during the year in the east and west.

As more physicians with special knowledge of tuberculosis than are already in the service will soon be needed, it is hoped that this demand will be supplied from the profession at large. Applications for admission to the schools with a view to service in bureau hospitals may be sent to Col. C. R. Forbes, Director, Veterans' Bureau, Washington, D. C.—Attention Clinical Director of Tuberculosis.

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THE MILITARY SURGEON

VOL. LII FEBRUARY, 1923 NUMBER 2

EXTRACTS FROM THE HISTORY, MEDICAL DEPARTMENT, UNITED STATES MILITARY MISSION, BERLIN, GERMANY, AUGUST 10, 1919[1]

BY MAJOR A. L. PARSONS

Medical Corps, United States Army

INTRODUCTION

BECAUSE no purely statistical statement can do justice to the unselfish activities of Major Parsons and his medical force while serving with my Mission, I have successfully insisted on a brief personal preface.

The United States Military Mission commenced to function December 10, 1918, when its total strength was three officers and two enlisted men. Later, and for several months, its commissioned and enlisted personnel numbered something in excess of 800. The duty of that personnel was to afford aid and comfort to allied prisoners of war in German hands. It was the most uniquely notable humanitarian enterprise of that historic period. Indeed, I have been unable to learn of any prior military organization attempting so great a task.

To catalogue the many things excellently done is not here practicable, nor is there at my command language I would deem adequate.

Operating in remarkable harmony with the French, British, Italian and Belgian Missions headquartering in Berlin, our Mission lived, moved and breathed internationally and injected into the situation that spirit and accomplishment which were so greatly appreciated by associates and beneficiaries. We dealt with representatives of every country in Europe and became closely acquainted with practically all of the heterogeneous elements of peoples and kindreds and tribes of whom but little is known on this side of the Atlantic.

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[1]Prepared in Office of the Surgeon, United States Military Mission.

Details are too voluminous even to be suggested. What I want to emphasize is that the medical forces, directly operated by Major Parsons, lived up to the best traditions of the profession and of our army.

George H. Harries,
Brigadier General, U. S. A.,
Chief of Mission.

PRELIMINARY HISTORY OF THE MISSION

Beginning of the Medical Department, United States Military Mission.—The Interallied Commission on the Repatriation of Prisoners of War was established as a branch of the Permanent International Armistice Commission, a few weeks after the signing of the Armistice. It was composed at first of three missions, American, British and French. Later, other nations were added. Its duties were the care and return to their homes of the allied prisoners of war. When this work was nearly completed, a subsidiary commission, the Interallied Commission on the Repatriation of Russian Prisoners of War, was formed. The American section of this last named commission was called the "United States Military Mission."

The repatriation of American, British and French prisoners of war had been practically completed before the establishment of the Medical Department of the United States Military Mission. A few prisoners were repatriated from time to time who were in hospitals when the main body of American, British and French prisoners was sent home.

Quite early in the history of the Interallied Commission on the Repatriation of Prisoners of War, it appeared that United States medical officers could be used with a distinct advantage in convoying trains of prisoners on account of the unique position they occupy in the army. Possessing practically all the powers of an army officer, their work, however, was always of a non-combatant type. It is also evident that a large part of the problems to be faced would have to do with the medical care of prisoners of war and with sanitation, a problem entirely within the sphere of the medical service.

To meet the initial requirements of the mission, six medical officers of the United States Army were requisitioned. They reported in Berlin between January 22 and February 3, 1919.

The Repatriation of the Balkan Prisoners of War.—While practically all the American, British and French prisoners had

been repatriated by February 1, 1919, there still remained in German prisoner of war camps a large number of Russian prisoners as well as many Roumanians, Serbians and a few Greeks. United States medical officers were used in convoying Roumanian and Serbian prisoners of war as they were repatriated.

Capt. A. L. Parsons, M.C., left Berlin January 30, 1919, to accompany a transport of Serbian prisoners as far as Vienna. He first went to the prisoner of war camp at Stargard to make the necessary arrangements. After a preliminary inspection of the prison camp and hospital, he arranged to have the first transport leave on January 31, and the second on the following day. It was necessary to leave forty sick Serbians in the hospital, with one orderly and two clerks. The transports departed as per schedule. The feeding of the men en route was very satisfactory. Both transports proceeded without special interruptions, though progress was slow. At Vienna on February 3, 1919, Captain Parsons turned over the Serbian prisoners to South Slav officers, who convoyed the transports to Serbia. In all, 2,000 Serbians were repatriated in this convoy. Captain Parsons returned to Berlin on February 6, 1919.

Capt. Leon Matassarin, M.C., and 1st Lieut. Nathan P. Barbour, M.C., left Berlin February 4, 1919, for Breslau, where they waited until February 7, 1919, for a Roumanian transport. This transport, Lazarettzug No. 20, composed of about 40 cars, 19 cars with 10 berths in each for bed patients, 5 third class cars for sitting patients, 1 operating car, 1 kitchen car, 1 baggage car, provided with a delousing plant, 1 supply car, 4 cars for the sanitary personnel, 3 heating cars and 3 coal cars left for Breslau February 7, 1919. It carried 303 Roumanian prisoners, most of whom were convalescent from influenza. The trip to Bucharest consumed eight days. Meals were served four times daily, and diets were given according to the type of disease. In general, the men were well fed. The kitchen and kitchen utensils were very clean, and the transport was kept in a very sanitary condition, warm and well ventilated. The sick were attended daily and well taken care of. On February 15, 1919, the Roumanian prisoners were delivered to the Roumanian Government at Bucharest. On March 6, 1919, Captain Matassarin and Lieutenant Barbour left Bucharest on the same train loaded with 282 German prisoners. At Krondstadt, 63 additional German prisoners were received, making a total of 345 prisoners. The transport arrived in Magdeburg, Germany, March 14, 1919, where

the prisoners were turned over to the German officials. Captain Matassarin and Lieutenant Barbour returned to Berlin on March 14, 1919.

Capt. Victor d'Ercole, M.C., and Capt. Edwin H. Hall, M.C., left Berlin on February 4, 1919, for Breslau. There they met Lazarettzug No. 2 on February 11, 1919, and departed for Bucharest on the same day with 350 Roumanian prisoners. On February 19, 1919, this sanitary train arrived in Bucharest where the prisoners were turned over to Roumanian authorities. Captain d'Ercole and Captain Hall left Bucharest March 8, 1919, with 304 German prisoners, arriving at Arnsdorf, Germany, March 17, 1919, where the prisoners were turned over to the German authorities. The accommodations, food and sanitary conditions on both trips (to Bucharest and return) were satisfactory.

First Lieut. Theodore H. Aschmann, M.C., left Berlin for Breslau February 18, 1919. There, on February 23, the third sanitary train was made up, of which he took charge. The number of Roumanians repatriated by this train was 408. Considerable trouble was experienced during the passage of this train through Hungary, a Hungarian soldier even going so far as to fire point-blank into one of the compartments containing Roumanian prisoners. Cars containing supplies were broken into and the supplies stolen. Owing to the dishonesty of the German quartermaster, who had charge of the buying of the supplies for the train, additional supplies had to be taken on at Krondstadt, as this rascal used the money entrusted to him for other purposes. The train arrived in Bucharest on March 3, 1919, where the prisoners were turned over to the Roumanian Government. The return transport left Bucharest on March 10, 1919, carrying 235 German prisoners of war and 135 German civilians. At Hannover, on March 23, 1919, these were turned over to the German authorities.

ESTABLISHMENT OF THE MEDICAL DEPARTMENT, UNITED STATES MILITARY MISSION

Organization of the Russian Prisoner of War Camps—When the Interallied Commission on the Repatriation of Russian Prisoners of War took over the administration of the Russian prisoner of war camps, twenty detachments of United States troops were requested, each composed of line officers, a medical officer, and from fifteen to twenty enlisted men. These detachments proceeded directly

from the A. E. F. to the camps to which they were assigned. They arrived between February 15 and February 22, 1919.

In order to better coordinate and direct the work of these medical officers, the Commanding General, United States Military Mission, on February 12, 1919, appointed Capt. A. L. Parsons, M.C., The Surgeon, United States Military Mission.

Capt. Albert H. Albers, S. C., arrived in Berlin March 12, 1919, and became medical supply officer. He not only supplied the United States troops with needed hospital supplies and medicines, but also sent out from time to time medical literature for the most part from the American Red Cross and the office of the Chief Surgeon, A. E. F.

The Surgeon's Office.—The Medical Administrative problem undertaken by the office of the surgeon was absolutely new, with nothing in the previous experience of the United States Army presenting a similar condition in recent years. Briefly, the situation was as follows: Approximately 30 prison camps contained a large number of Russian prisoners of war, variously estimated from 300,000 to 700,000, by the German authorities. Fully half of these prisoners were not located directly in the camps but were working on the farms and in the factories adjacent to the camps. All information that could be procured from the German authorities was very inaccurate, due to the unsettled conditions of the time, and the constant movement of the prisoners from camp to camp, from kommando to camp and from camp to kommando. The camps presented a problem of care and sanitation which was unique in medical history. For four years thousands of ignorant Russians had been grouped together in these camps under the authority of a government whose reputation for unscrupulousness and frightfulness is so well known by this time. The signing of the armistice, however, so weakened the German authority that the prisoners were able to do almost as they pleased. The result was a body of ignorant men of low morale, from four years of harsh treatment, suddenly allowed to do as they pleased in these camps. The resulting sanitary conditions can be adjudged from the first sanitary reports made by the United States medical officers, a typical example of which is given further on.

As the Surgeon's Office was a part of the United States Military Mission and the United States Military Mission a part of the Interallied Commission on the Repatriation of Russian Prisoners of War, and the Interallied Commission on the Repatriation of

Russian Prisoners of War was composed of several missions, it early became necessary to establish an effective liaison with these other missions. This involved a correspondence in English, French, Italian, German and Russian, and represented the connection of the Surgeon's Office with the British Red Cross, the French Mission, the Italian Mission, the Russian Red Cross and the Kriegsministerium, as well as with the American Red Cross and the Headquarters of the Interallied Commission itself. Liaison was maintained in two ways: officers were attached to the Surgeon's Office, who spoke the various languages and orders and reports were issued in these languages. A Russian typewriter was even made use of.

The Interallied Commission employed thirty-two Russian doctors and fifteen Russian nurses in the prisoner of war camps. Of these, seven doctors and five nurses were really Ukrainians. The policy of the Interallied Commission would not permit the Ukrainian doctors and nurses being employed except as Russians.

The Surgeon of United States Military Mission was also made the director of medical activities of the Interallied Mission.

ENLARGEMENT OF THE MEDICAL DEPARTMENT, UNITED STATES MILITARY MISSION

The medical officers assigned to these first twenty camps at once began to report the conditions in the camps and the contiguous territory. It early became evident that the problem was too large for the medical personnel on hand. Accordingly, additional medical officers, dental officers, tuberculosis specialists and eye specialists were requisitioned.

Upon their arrival in Berlin, March 19, 1919, the medical officers were sent to those camps which seemed to require additional medical personnel and to camps which contained no United States medical officers. Some of the medical officers were sent on tours of inspection into areas about which little was known.

The need of an inspector to personally supervise and coordinate the work of the medical officers in the camps soon became apparent. Accordingly Lieut. Col. Hamner C. Irwin, M.C., was assigned to this work. He inspected practically all the Russian prisoner of war camps in Germany.

GROUPING OF THE CAMPS INTO ADMINISTRATIVE AREAS

The Russian prisoner of war camps in the Seventh and Tenth Army Corps were under the control of the British. The camps in

the Erlangen Area were under the Italians. The remainder of the camps in Germany were under American administration. They were classified into main camps, and those subsidiary to the main camps; of the former there were twenty-eight and of the latter eighty-six.

The American Red Cross—The existing armistice conditions gave the Interallied Commission at Berlin the right to take up directly with the German Government all questions relative to Russian prisoners and stipulated that the Interallied Commission was to be assisted by the American Red Cross. Accordingly, the American Red Cross Commission to Germany was organized in January and arrived in Berlin on February 17, 1919, with a personnel of about sixty. The following officers were in charge: Lieut. Col. Carl Taylor, Commissioner; Lieut. Col. Edward W. Ryan, Deputy Commissioner; Major Benjamin Hodge, Director, Bureau of Requirements and Supplies; Major James J. Babbitt, M.D., Director, Bureau of Medical and Surgical Relief.

The object of the American Red Cross Commission was to furnish medical and surgical relief, hospital equipment and diet foods and clothing for Russian prisoners of war. The most important work was the transport, storage and distribution of food for approximately 300,000 Russian prisoners. Its main depots were at Mainz and Coblenz. From these two central points, food was shipped in by freight trains to subsidiary depots at Stettin, Berlin, Magdeburg, Dresden and Nurnberg. From these depots, the food was in turn shipped to the various prison camps, about seventy-five in number, scattered throughout Germany, where it was turned over to the interallied officer in charge, and the work of the Red Cross as far as food was concerned was at an end. The actual distribution of food was in the hands of the Allied officer. The American Red Cross Commission made periodical inspections of the camps, reporting on the physical and sanitary condition for the Interallied Commission. It also maintained at each camp an American Red Cross Store, where supplies of clothing, diet foods and medicines were on hand.

The personnel employed was as follows: 45 American Red Cross, 25 civilians, 30 United States Army enlisted men, 1 United States Army officer.

The food furnished by the Germans to the Russians was deficient in certain elements. These elements the American Red Cross endeavored to supply. That this was done can be seen by comparing

the following two menus. The first is a regular German issue, which was served during the week ending February 23, 1919. The second is the German issue supplemented by American foods, and was served during the week ending June 28, 1919.

GERMAN MENU SERVED TO RUSSIAN PRISONERS OF WAR

	Breakfast	*Dinner*	*Supper*
Sunday:	Grms.	Grms.	Grms.
	50 Mix meal	10 Mix meal	200 Carrots
	10 Sugar	100 Carrots	150 Potatoes
	5 Margarine	100 Potatoes	15 Mix meal
		10 Sugar	8 Margarine
		75 Barley	
Monday:	200 Cocoa essence	200 Potatoes	200 Potatoes
	15 Sugar	75 Barley	100 Carrots
	0.1020 Saccharine	20 Mix meal	20 Mix meal
		5 Margarine	5 Margarine
Tuesday:	50 Mix meal	500 Beets	200 Potatoes
	10 Sugar	150 Potatoes	100 Fish roe
	0.020 Saccharine	50 Sausage	20 Dried vegs.
		10 Mix meal	5 Margarine
		10 Bone Meal	3 Vinegar
Wednesday:	8 Coffee essence	200 Potatoes	400 Potatoes
	10 Sugar	75 Barley	50 Cheese
	0.020 Saccharine	20 Mix meal	
		5 Boullion cubes	
Thursday:	50 Mix meal	600 Turnips	50 Barley
	20 Sugar	150 Potatoes	20 Mix meal
	5 Margarine	10 Mix meal	5 Boullion cubes
		5 Margarine	5 Margarine
Friday:	20 Cocoa essence	200 Turnips	200 Turnips
	15 Sugar	100 Mix meal	10 Mix meal
	0.020 Saccharine	75 Barley	20 Dried vegs.
		10 Boullion cubes	5 Margarine
Saturday:	3 Tea sub.	400 Carrots	100 Turnips
	10 Sugar	200 Turnips	75 Barley
	0.020 Saccharine	20 Mix meal	10 Mix meal
		10 Boullion cubes	50 Marmalade
			5 Margarine

Bread: 285 grammes daily.

GERMAN MENU SUPPLEMENTED BY AMERICAN ISSUE OF FOODSTUFFS

	Breakfast	*Dinner.*	*Supper*
Sunday:	Grms. 10 Tea 15 Sugar	Grms. 200 Potatoes 10 Fat 60 Meat 75 Barley 100 Carrots 10 Mix meal	Grms. 10 Fat 60 Meat 200 Carrots 5 Margarine 15 Mix meal
Monday:	10 Tea 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 200 Potatoes 100 Carrots 20 Mix meal 5 Margarine	10 Fat 60 Meat 300 Potatoes 20 Mix meal 5 Margarine
Tuesday:	10 Tea 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 50 Sausage 500 Beets 150 Potatoes 15 Mix meal	10 Fat 60 Meat 100 Fish roe 200 Potatoes 5 Margarine 20 Dried vegs.
Wednesday:	20 Cocoa 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 200 Potatoes 75 Barley 5 Boullion cubes	10 Fat 60 Meat 400 Potatoes 50 Cheese
Thursday:	10 Tea 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 400 Turnips 150 Potatoes 10 Mix meal 5 Margarine	10 Fat 60 Meat 50 Barley 20 Mix meal 10 Boullion cubes
Friday:	20 Cocoa 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 200 Turnips 75 Barley 50 Noodles 10 Boullion cubes	10 Fat 60 Meat 150 Turnips 20 Mix meal 20 Dried vegs. 5 Margarine
Saturday:	10 Tea 15 Sugar 0.020 Saccharine	10 Fat 60 Meat 300 Carrots 200 Turnips 20 Mix meal 10 Boullion cubes	10 Fat 60 Meat 100 Turnips 75 Barley 10 Mix meal 5 Margarine

Bread: 600 grammes daily.

OPERATIONS OF THE MEDICAL DEPARTMENT, UNITED STATES MILITARY MISSION

The Work of the Medical Officer, United States Troops, in Camps.—The duties of the medical officer at a Russian prisoner of war camp may best be expressed in the words of a circular which was issued to all medical officers upon reporting for duty. "Medical officers occupy a dual rôle. On the one hand, they should attend the needs of the United States troops at their camp; on the other hand their relation with the German medical officers is that of adviser and supervisor—they should urge and help in the institution of all sanitary measures beneficial to the prisoners. It is not intended that they shall actually treat the sick Russians, but they should see to it that proper treatment is given the prisoners." In certain camps where the medical officer was the only Allied officer present, he had to assume the duties of a line officer as well.

The most important report that the medical officer was called upon to render was the Weekly Medical Report, which had as its purpose the keeping of headquarters advised of the sick situation in the camp. The Interallied Commission was working under such conditions that it was not known when or where the repatriation of Russian prisoners would take place. No one could tell in advance what transportation problems would arise, where sick would be concentrated, how long they would be on the transport, or what their ultimate destination would be. Hence, it was necessary to keep on hand an up-to-date compilation of the sick data, with special reference to the total number of sick, their transportability as sitters or bed cases, the number of mental cases and the number of first stage and all cases of tuberculosis. This Weekly Medical Report also served the purpose of keeping headquarters advised of the sick conditions at each camp in order that recommendations and improvement could be sent out whenever necessary.

The medical officer was called upon to aid in the concentration of the mental cases in special insane asylums. Through the assistance of the Kriegsministerium, this was, in a great measure, accomplished. The total number of mental cases occurring among the Russian prisoners of war was 487.

The Weekly Medical Report submitted by the medical officers were consolidated in the Office of the Surgeon. On account of the continual changes taking place, these consolidated reports were only approximately correct, but at the same time they fur-

nished the best obtainable data for use in any repatriation scheme that might be carried out. Probably the least accurate of the figures given are those for the kommandos, because it was impossible to accurately count these Russian prisoners working in the surrounding country. The consolidated Weekly Medical Reports for the period ending March 23, 1919, and up to August 9, 1919, the date the mission began to turn over the camps to the German authorities, follow. These figures do not include statistics from the Seventh and Tenth Army Corps, which were under the administration of the British.

WEEKLY REPORTS OF RUSSIAN PRISONERS OF WAR

Date	*Camp*	*Kmo.*	*Sick*	*T.B.*	*Mental*	*Non-Tr.*	*Tr.-Lying*
March 22, 1919...	111670	112429	7136	769	273	....	....
March 29, 1919...	101588	129505	7469	959	393	....	....
April 5, 1919.....	98812	127375	8132	1192	400	....	....
April 12, 1919....	107434	125123	8114	1064	406	415	1258
April 19, 1919....	107935	118704	8153	1082	376	636	1833
April 26, 1919....	108132	101686	7734	1269	396	499	2117
May 3, 1919.....	110489	97811	8277	1078	448	496	2024
May 10, 1919....	111141	92680	8227	1270	422	464	1414
May 17, 1919....	107145	93428	8414	1448	380	474	1430
May 24, 1919....	105741	96026	7725	1390	394	532	1600
May 31, 1919....	102814	94572	8067	1381	436	360	1514
June 7, 1919.....	98231	91203	7043	1401	487	340	1556
June 14, 1919....	97198	93077	7243	1300	343	398	1422
June 21, 1919....	93283	94755	6503	1125	395	353	1273
June 28, 1919....	88691	93455	6450	1104	388	434	1157
July 5, 1919......	84827	95775	6199	1158	378	379	1254
July 12, 1919.....	79183	93608	6211	957	369	393	2202
July 19, 1919.....	73792	100983	5904	929	320	347	1096
July 26, 1919.....	65551	98540	6118	991	443	362	1304
August 2, 1919...	61895	106077	5755	743	290	334	1249
August 9, 1919...	58174	108884	5725	787	316	316	1110

Meaning of Symbols Used: Camp, Number of prisoners in camp; Kmo, Kommandos; Non-Tr., Not transportable; Tr.-Lying, Litter patients.

These figures, when compared, give considerable information as to what was occurring in the prisoner of war camps. Some of the wide variations require explanation. The most important conclusions to be drawn from a comparative study of these reports are as follows:

(*a*) Prisoners moved from camps to kommandos when the weather became warmer. Prisoners who had been repatriated and found conditions so bad in Russia returned in some instances to their former prison camp. After they had told their story, it was noted that many prisoners gave up the idea of immediate repatriation and went on to kommandos to work.

(*b*) Prisoners moved from kommandos to camps during cold

weather because they wished to secure the interallied issue of food and clothing. Whenever it was announced that repatriation was about to begin, this news seemed to spread quickly throughout the country, and in a short time prisoners were leaving their jobs on the kommandos and returning to the camps in order to be sent home.

(*c*) Statistics show that approximately 40,000 prisoners were sent to Russia. From the recapitulation given above, it is evident that the number of Russians in Germany decreased by 90,000 during the period that the Interallied Commission had control of the camps; the difference of 50,000 can be accounted for by the fact that many prisoners escaped from camps and returned to Russia of their own volition. In some camps as high as 200 prisoners made their escape in one day during the warm weather.

(*d*) During June 300 tuberculosis cases were sent to Switzerland. Naturally the consolidated Weekly Medical Report shows a corresponding drop at that time from approximately 1,400 to 1,100 cases of tuberculosis.

(*e*) Early in April the total number of sick seemed to increase a great deal. As a matter of fact, this apparent rise was due to the discovery of tracoma and tuberculosis by the specialists who examined the Russian prisoners.

(*f*) The Erlangen area did not furnish accurate reports for a long time. The Italians who took over the administration of this area were slow in adopting American methods of reporting conditions in their camps, so that it was difficult to record accurate figures concerning prisoners under their control. Finally, however, the Italians did send in as good and as complete reports as were received from our own medical officers.

(*g*) From other camps, reports were not obtained for considerable periods of time. This was because there was no medical officer present in these camps to furnish the desired reports. In such cases, the last report obtained was used in compiling our statistics.

(*h*) The consolidated reports given above do not include the Seventh and Tenth Army Corps. When the Interallied Commission took over the administration of the Russian prisoner of war camps, the Seventh and Tenth Army Corps contained approximately 45,241 men in camp; 5,998 men on kommandos and 1,380 men sick. On August 1, 1919, this same area contained 27,717 men in camp; 6,025 men on kommandos and 1,370 men sick.

The original sanitary condition of practically all the Russian prisoner of war camps was frightful. Words can give only a slight idea of the filth and dirt in which these Russians lived. That this problem in sanitation was satisfactorily solved is shown by a comparative study of the two sanitary reports from Camp Merseburg given below.

SANITARY REPORT, FEBRUARY, 1919

Public Buildings and Grounds.—Buildings constructed of wood and plaster; filthy; no sanitation; scraps of food thrown into corners which are mouldy and sour. Windows are never opened. Barracks are badly overcrowded, some of them contain twice as many men as they should. Grounds filthy. Other barracks are unoccupied and still contain rubbish and clothing left by other prisoners. Prisoners do not use latrines, but defecate and urinate wherever they happen to be, leaving a path in the company street only large enough for one person to walk at a time, without stepping in the filth. Prisoners eat raw vegetables, the peelings of which are dumped in the handiest place, causing piles of decaying food which give the entire camp a sour odor.

Drainage, Sewerage, Waste Disp.—Poor drainage; camp located in a hollow; pools of water stand when it rains. Drainage ditches are full of stagnant urine. Sewerage system clogged. Latrines in bad condition, only roofs and rails upon which prisoners sit are left, rest of building burned for fuel. Latrine pits full, uncovered and exposed. All waste stays wherever it is thrown.

Sanitary Appliances.—No filters. Sterilizers can accommodate clothes of about 100 prisoners at a time. No incinerators.

SANITARY REPORT, JUNE, 1919

Public Buildings and Grounds.—In good condition, swept daily. All rubbish is placed in boxes and hauled away. Windows are opened daily. All barracks have the correct number of men to the required amount of air space. Prisoners have again acquired the habit of using the latrines and do not defecate in the company street. Russian sanitary squads collect all garbage and sweep the streets daily, keeping the grounds in good condition.

Drainage, Sewerage, Waste Disp.—Although camp is located in a basin, the old drainage ditches have been opened and new ditches dug, making drainage very satisfactory. Sewerage system in good condition and all waste water is properly carried away. Latrine walls replaced, pits boxed again, properly cleaned. Latrine squad works daily keeping latrines clean and putting in lime. All waste is collected daily, hauled away from camp and buried.

Sanitary Appliances.—No filters. The sterilizers working daily. Clothes of about 750 men sterilized daily.

SANITARY REPORT, FEBRUARY, 1919 (*Continued*)	SANITARY REPORT, JUNE, 1919 (*Continued*)
Water Supply.—City of Merseburg.	*Water Supply.*—City of Merseburg.
Food Supply.—Food given prisoners is either partly frozen or decayed and is given in the form of soup. Mostly vegetable. Canned milk used in the hospital; no milk in camp.	*Food Supply.*—Of good quality and sufficient in quantity. The German issue is supplemented by the Inter-allied Commission issue of 140 grammes of meat and other foodstuffs daily. Canned milk is used in the hospital.
Clothing of the Men.—Poor. It is mostly a mixture of military and civilian clothing, most of which is in rags. No socks. Shoes are mostly wooden.	*Clothing of the Men.*—Good. The commission has issued the prisoners socks and underwear. The Germans have issued shoes to most of the prisoners who have not been supplied by the Red Cross.
Prevailing Disease.—Only ordinary sickness with exception of two cases of erysipelas. Thirty cases of tuberculosis in hospital, not counting those loose in camp. No venereal inspection on account of lack of discipline; evidence of considerable venereal disease in camp.	*Prevailing Diseases.*—No contagious diseases and only ordinary sickness prevails. Venereal disease is prevalent, but it is impossible to induce the prisoners to take prophylaxis.
Venereal Statistics.—None.	*Venereal Statistics.*—None.
Recommendations.—That a German sanitary squad be sent to this camp to remedy sanitary conditions, also that benzine be sent here for the odorless evacuator.	*Recommendations.*—None.

In so far as it was possible, efforts were made by the medical officers to concentrate the tuberculosis and mental cases with the idea of simplifying the transportation problem when repatriation of these types of sick Russians should begin.

The Work of the Tuberculosis Specialists.—The White Plague has been the greatest scourge of the Russian prisoner of war. Indeed, practically all reports gave as the cause of death, pulmonary tuberculosis. Among the contributing causes to this condition were insufficient clothing, poor food, and overcrowding, bad ventilation and the Russian's natural dislike to outdoor exercise. With this favorable environment, tuberculosis progressed rapidly and claimed many victims.

The problem of tuberculosis could be met only by a prompt detection, classification and isolation of all tuberculosis cases, coupled with proper care and treatment. Ten tuberculosis

specialists were sent to the various camps for this purpose. Approximately 130,000 Russian prisoners in camps were inspected. Cases looking suspicious or presenting any symptoms of tuberculosis were given a thorough examination, and, if necessary, placed under observation a sufficient length of time to make a diagnosis. They were classified into first stage tuberculosis and all other cases of tuberculosis with the idea in view that, should the opportunity arise, the first stage tuberculosis cases might be sent to a climate that would tend to arrest the development of the disease. The total number of tuberculosis cases found was approximately 2,062. The total number of deaths from tuberculosis for the period of March 1, 1919, to August 1, 1919, was 485.

Several efforts were made to establish areas for the concentration of tuberculosis cases. Early in March a plan was formulated for concentration of first stage tuberculosis cases at Claustal, but owing to the difficulty in removing 200 Ukrainians who were in that camp, the other movement was abandoned. Then the scheme for sending first stage tuberculosis cases to Odessa was advanced, but political conditions in the ports made this impossible. The Russian Red Cross, having considerable funds at its disposal, proposed to send 300 tuberculosis cases to Switzerland, where they could be given hospital care and proper treatment. These cases were accordingly concentrated at Camps Guben, Merseburg, Ulm and Wetzlar, and later taken by hospital trains to Constance.

The Work of the Ophthalmologist.—It was early noticed that quite a number of Russian prisoners were suffering from trachoma. Accordingly, the ophthalmologists were instructed to examine the prisoners for trachoma and to adopt the policy of isolating all cases and instituting proper treatment. Approximately 130,000 prisoners were inspected. That this work really meant a great deal can be deduced from a résumé of the ophthalmologist's work at Camp Lamsdorf, which is given in the next paragraph.

The ophthalmologist at Camp Lamsdorf found 14 cases of trachoma in the lazarett upon his arrival at the camp. He immediately instituted a systematic examination of all the prisoners in the camp and found 250 additional cases of trachoma. A trachoma hospital was at once organized with adequate personnel and fixtures. During the week of April 29, 1919, to May 5, 1919, the entire camp was again examined, resulting in the finding of 141 new cases of trachoma. A reexamination of the camp from

May 31, 1919, to June 7, 1919, revealed 54 new cases of trachoma. The following summaries under the dates given indicate the work done at the trachoma hospital:

	May 17	*May* 24	*May* 31	*June* 7
Population	305	306	306	313
Operations	67	133	18	1
Treatments	3,388	4,264	4,283	4,301

The total number of cases discovered among all prisoners was 2,341, making the percentage of trachoma about 1.17.

The Work of the Dental Officers.—The work accomplished by the dental officers was largely confined to the United States troops. Unfortunately the Russians were not easy to persuade to have dental work done. As a rule the Russians had splendid teeth; however, the dental officers did 1,987 fillings, 85 pieces of crown and bridge work, and 3,025 other operations. This work represents many thousand sittings. Over 15,000 men were examined to ascertain if treatment was required.

Epidemic Diseases.—Medical officers were required to report the occurrence of an epidemic disease by wire to the Office of the Surgeon, in order that all available means might be brought to bear promptly upon the situation. This measure, coupled with the prompt and energetic action of the medical officers in camps resulted in the absolute control of all epidemic diseases which took place. Considering the great number of Russian prisoners and the conditions under which they lived, the occurrence of epidemic diseases was comparatively small.

One case of smallpox occurred.

There were six cases of diphtheria recorded.

The difficulties of exact diagnosis make influenza statistics very inaccurate. The mortality, however, was very low; only 45 deaths reported as due to this disease.

Typhus fever, as a rule, originated in a new arrival at a camp. This new arrival may have come in from a kommando, from another camp, or was possibly a new prisoner taken by the Germans on the eastern front. The discovery of the case was followed by its immediate isolation, the isolation of possible contacts and prompt delousing of the entire camp, with disinfecting of the clothing. Each German army corps has a body of German troops who are especially trained in delousing and disinfecting. When typhus occurred in any camp, this body of troops was brought to that

camp to take entire charge of the delousing situation. After the armistice was signed, these "Sanitary Squads" did almost as they pleased, so that it was always necessary for the medical officer to see that delousing and disinfecting was properly done. Delousing was difficult to accomplish, owing to the scarcity of soap. One hundred and sixty-four cases of typhus were reported, 91 of which occurred at Camp Heilsburg and 36 at Camp Pr-Holland. Seventeen deaths were reported as due to typhus fever. It has been observed that prisoners, after having been deloused, deliberately placed their arms in lousy clothing in order to see whether the lice would crawl onto their bodies. It was the common belief among the Russians that lice avoided a person infected with typhus fever.

The United States Detachment.—United States troops on duty at the Russian prisoner of war camps were quartered in some instances in towns close to the camp, and, in others, in camp barracks set apart for their use. Living conditions on the whole were excellent. Food was supplied by the Quartermaster Department.

Officers of the Medical, Dental and Sanitary Corps were relieved from duty with the mission as their work was finished and as their services could be spared, until on August 20, 1919, there remained only the Surgeon and the Assistant Surgeon on duty in Berlin.

The United States Military Mission was remarkably free from disease. With an average strength of about 600 there were in more than six months only 18 cases of venereal disease. One death occurred, from pneumonia. The command escaped any epidemic.

The Repatriation of the Russian Prisoners of War.—On May 20, 1919, six United States medical officers and dental officers were sent to Marienburg, West Prussia, for the purpose of convoying transports which were taking Russian prisoners into Russia. During the period from May 27, 1919, to June 15, 1919, nine train loads of prisoners were convoyed by these officers, each train averaging about 1,800 Russians. The prisoners were taken through the German lines to a point near the Bolshevik front, detrained and given sufficient food for a few days' march. As the Interallied Commission's representative, it was the duty of these medical and dental officers to properly care for these prisoners en route and to see that the distribution of food was correctly made.

In addition to convoying the prisoners, a medical officer was sent on July 5, 1919, into Russia for the purpose of establishing

an advance food depot for the feeding of 3,600 prisoners whose further progress into Russia had been stopped.

On August 2, 1919, the S. S. *Christian Nebe* sailed from Hamburg with 2,000 Georgians, and on August 8, 1919, the S. S. *Guljemal* sailed from Hamburg for Novorissisk for the purpose of transporting 702 Cossacks and 420 Turks. Both of these ships and the prisoners they contained were inspected by United States medical officers before they left Hamburg, to see that there were no infectious diseases taken aboard and that the sanitary arrangements of these ships were satisfactory.

The Further Repatriation of the Balkan Prisoners of War.—In addition to the Balkan prisoners repatriated during February, 1919, other Roumanians and Serbians were sent from time to time to their own countries. Three medical officers were used to convoy these trains. In addition, another medical officer was sent to Serbia in June to collect sick German prisoners of war and to see that they were returned to Germany.

THE MEDICAL OFFICER AND THE EMPLOYEES' COMPENSATION ACT[1]

By Captain JAMES CHAMBERS PRYOR
Medical Corps, United States Navy

THE membership of the Association of Military Surgeons of the United States is composed of the medical officers of the Army, Navy, and Public Health Services, and while we have duties in common, the heterogeneous character of our activities has caused difficulty in selecting a subject which might interest equally the medical officers of the three services.

In discussing some of the duties imposed upon us by the Federal Employees' Compensation Act of September 7, 1916, it is felt that there is a common interest in that the act concerns functions common to us all.

The law imposes: (1) obligation upon the Government as employers, (2) obligations upon the employee, and (3) very definite duties upon the medical officers of the services as agents of the Government.

OBLIGATIONS UPON THE GOVERNMENT

The act is beneficent in character, and through it the Government, as employer, assumes certain obligations to the injured employee which may be roughly outlined as follows:

(*a*) Provision of such reasonable medical, surgical, and hospital services as may be indicated in case of injury received by the employee in the line of duty: "Such services and supplies shall be furnished by the U. S. Medical Officers and hospitals," when practicable.

(*b*) Provision for a compensation during the disability, if it is temporary, or, if the disability is permanent, a continuing compensation is paid, or a lump sum settlement may be made.

(*c*) Provision in case of death of an employee resulting from an injury received in the line of duty, and occurring any time within six years of the receipt of the injury, for payment of burial expenses not to exceed one hundred dollars, and a liberal monthly compensation to be paid to the widow, widower, children, parents, or other dependents, as the case may be.

OBLIGATIONS OF THE INJURED

The liberality of the act makes it more than otherwise incumbent upon the injured employee to comply strictly with the reasonable regulations concerning the reporting of injuries and resulting disabilities.

Employees injured in the performance of their duties are required:

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[1]Read by title at the 30th Annual Meeting of the Association of Military Surgeons of the United States; Washington, D. C., October 12-14, 1922.

(*a*) "To immediately go for treatment to the medical officer of dispensary of the establishment in which he is employed."

(*b*) To report (or cause to be reported) to his official superior the occurrence of the injury within forty-eight hours.

(*c*) To avail himself of government facilities for treatment.

(*d*) To submit to such medical or surgical examinations and treatment as the Employees' Compensation Commission may require.

(*e*) To comply with all reasonable rules and requirements of hospitals while under treatment.

(*f*) To furnish evidence and make claim for compensation within sixty days after receipt of injury. In case of death a period of one year is allowed to beneficiaries in which to file claim.

OBLIGATION OF THE MEDICAL OFFICER

The duties added by the act to those normal to the service medical officer are diverse and serve to make his work correspondingly difficult.

He must bear in mind a dual standard of physical efficiency.

The physical qualifications which are required for enlistment in a military or naval service are not required for employment in the civil service. Age, and physical defects which would disqualify an individual for enlistment in the Army or Navy, would not operate as causes for rejection for applicants for civil service employment; e. g., an individual suffering with valvular heart disease may be employed if the lesion is compensated.

Fundamentally, a personnel of a quality differing from a military and naval personnel must be dealt with, and the conditions are essentially different, hence the service medical officer must become at once a military-industrial physician and surgeon when stationed at a government industrial plant.

Factors bearing upon the health and comfort of the two personnels are common, it is true, but at a large industrial plant such as the Norfolk Navy Yard the medical officer must familiarize himself with industrial processes which normally do not concern him; e. g., the hazards connected with sand blasting, planing, moulding, galvanizing, etc., etc., probably have had little more than an academic interest for the military medical man who suddenly finds himself ordered to perform the duties of one of the specialties in medicine, namely, industrial surgery.

From the foregoing it may be inferred that the medical officer serving at a government industrial plant, in addition to the performance of the duties to officer and enlisted personnel, must consider the industrial matériel and personnel which are so intimately correlated as to be almost dissociable for purposes of analysis and study.

A careful study of the problem with a view to prevent industrial

injury or disease brings the medical officer to a consideration of: (1) The environment, and (2) the individual.

Environment

(*a*) *Air.*—The various industrial pollutions of the air must be reduced to a minimum whether due to dust (inorganic or organic), to smoke, or to any one of the numerous gaseous poisons; e. g., recently a workman was making repairs inside the smoke pipe of the U. S. S. *Henderson.* He came for treatment in a state of general erythema, and irritation of conjunctival and nasal mucosa.

The back of his overalls, shirt, and undershirt actually and literally had fallen out. I told him he would be arrested if he started home! After appropriate treatment, a careful examination of his surroundings showed that the soot inside the smokepipe had a content of 35.71 per cent of sulphuric acid, resulting from combustion of the fuel oil having a sulphur content higher than that permitted by navy specifications.

The temperature and humidity, as well as the composition of the air, must be watched. Extremes of temperature and humidity are likely to cause conditions commonly seen after exposure to them.

Assuming that chemical composition, temperature, humidity, and pressure of the respiratory air are ideal, workers with pneumatic tools are liable to injury; e. g., X was working on a turret on the U. S. S. *Nevada* when a pneumatic tool slipped from the hand of another workman, and a jet of compressed air struck X, hurling him from the top of the turret to the deck, a distance of probably 15 feet, and causing severe contusions. Luckily no bones were broken.

In this connection it may be interesting to recall that several cases of rupture of the intestine have been reported following the playful "shooting" of a jet of compressed air at the buttocks of a stooping fellow-workman.

Occasionally men using pneumatic tools suffer from muscle strain, or even more serious incapacity; e. g., M, a chipper and caulker, who is at present under observation, commenced to suffer progressive loss of strength in the right forearm and hand about a year ago. This process continued until he is no longer able to hold his pneumatic hammer. A well-developed neuritis accompanied by wasting of the muscles of the hand is present, the clinical picture resembling in some respects that of amyotrophic lateral sclerosis.

Accidents to divers occasionally are observed, but they, as caisson disease, are more generally known.

The military-industrial surgeon must supervise the ventilation of shop and work stations with a degree of meticulous attention not necessary in the ordinary routine of his military duties, for often he

must point out the need of hoods and exhaust fans for the removal of noxious gases, respirators and helmets.

(*b*) *Light.*—Illumination of work stations must receive close attention. Interior walls should be white, working stations should have proper foot candle intensity upon vertical and horizontal planes, and glare should be avoided.

The military-industrial surgeon soon finds that accidents to personnel and spoilage of material result from insufficient illumination.

Extreme intensity of light contributes its quota in injuries. Oxyacetylene welders, electric welders, furnace welders and electricians have been especially susceptible to effects of sudden extreme intensity of light; e. g., N, an electric welder, applied for treatment for electric ophthalmia this morning. He had been using an electric welding apparatus and employing insufficient eye protection.

Goggles, shields, helmets, and protective garments should be provided and *used*. Many workers appear to think that a light is an object to be looked at rather than an aid to vision when properly employed.

(*c*) *Water.*—Water supplies require even greater supervision in industrial than in military life, principally because a military or naval personnel has had impressed upon it the importance of elementary sanitary precautions, and has been required to observe them until it does so habitually.

The civil workers—many of them—are heedless, and some evince a spirit of bravado in direct defiance of possibly misunderstood precautionary measures.

Having seen no one suddenly stricken after violation of rules, by agony or death as a condign punishment, they seem not to realize the possible danger from mouth-borne infections. They remind one of the mule sold by one darkey to another. The next day the purchaser said to the seller, "Dat mule you sold me is blind. He was running around in the lot and run head-on right into a big tree. He's blind."

Whereupon the seller replied, "No, he ain't blind. You know what's the matter with that mule? He just don't give a damn."

(*d*) *Handling heavy objects.*—At a station such as the writer's some of the workers are handling objects varying in weight from a feather pillow to the capacity of a 150-ton crane. Recently I saw a subchaser lifted in slings out of the water and lowered on to a cradle on the dock.

In such rigging and lifting accidents frequently occur; e. g., four days ago, Z was on the platform of a locomotive crane. As the crane swung the counter weight caught his left foot, and he sustained a compound or open fracture of both bones of his left leg.

(*e*) *Electricity.*—High power electricity causes burns, eye injuries,

etc., and within the past year two men have been killed by it. One man was found lying dead at a circuit-breaker on a line carrying 11,000 volts.

His duties did not call him into the circuit-breaker. Possibly he was—as is done by men at times—attempting to light a cigarette by causing an arc. Possibly the death was intentional suicide. There were no witnesses.

The second fatality occurred while an electrician was at work upon a 2,300-volt circuit which accidentally became short-circuited through his vertex, the other point of contact being at the lower angle of the left scapula.

(*f*) *Steam.*—Obviously there are many possibilities of injury to workers connected with generation and control of steam. Burns frequently occur; e. g., C, having been informed that steam had been shut off, broke a steam line to make repairs. Steam unfortunately was still on the line, and when the joint was broken live steam burned his face painfully, and live steam destroyed his left eye.

(*g*) *Poisons.*—The medical officer has to be constantly on guard to prevent poisoning both by particulate matter, as in lead poisoning, and gaseous, as in carbon monoxide, benzol, gasoline, etc.

The shops and workers should be inspected frequently and prophylactic measures prescribed and employed.

(*h*) *Machinery and industrial processes.*—In order to attempt to prevent, and, in cases of occurrence, intelligently to report injuries caused by machinery or industrial processes, the military-industrial medical officer must acquire an elementary knowledge of the work; e. g., he must know whether the moving members of a machine are properly guarded to afford a maximum of protection to the workers, and whether the necessary safeguards are being employed in the various hazardous activities.

From the foregoing it may be seen that, in my own case, the naval-industrial medical officer has to consider very wide differences in the environment of the civil service worker; e. g., it is a far cry from sanitary operation of an ice factory recently outlined to the prophylactic measures to be taken in the foundry where molten metal often attains a temperature of 2,700° F. The foregoing have been briefly mentioned merely to indicate the diversity of the work and can in no way be considered a complete catalog of the many mechanical, physical, and chemical forces causing injury at this station.

Personnel

It has been shown that a large majority (75 per cent or more) of the accidents causing injury were due to carelessness on part of the person injured or carelessness on the part of someone else.

In other words, experience appears to show that carelessness is responsible for the payment of about 75 per cent of the total amount being paid and to be paid under the terms of the Compensation Act, while only about 25 per cent may be classed as unavoidable and due to inherent defects in matériel.

Whether this carelessness is due to fatigue, illness, home worry, drink, dissatisfaction, or to sheer indifference is a problem often taxing the tactful investigator to the utmost. Some of the carelessness may be prevented by removal of the cause, but frequently this can not done; e. g., T, while operating a punching machine, punched off a portion of his own right index finger. As this painful accident could have occurred only after starting the machine with his own foot, he had complete control of it, yet the injury could not have taken place if his hand had been in proper position.

The injury was received shortly after coming to work in the morning, the man was sober and well, but the fact was elicited that for a day or two he had been almost beside himself as result of domestic worries.

When possible, the military-medical officer should try to prevent accident due to the incapacity of the worker; e. g., recently a man under the influence of liquor was going to work in a position where his mental state might result in injury to himself or others.

In another instance, P applied for treatment for failing vision. Ophthalmoscopic examination showed albuminuric retinitis. The vision in each eye was reduced to 1/50.

As P was the driver of a 5-ton motor truck, it can be seen how disastrous might be the result of his infirmity. Although advised of his condition, and thought by the medical officer to be at his home, he had resumed work and was actually driving a loaded 5-ton motor truck drawing two loaded trailers through the street when the matter was officially and hurriedly brought to the attention of the proper authority.

In a general way, the personnel may be considered with reference to their complaints as:

(*a*) Honest sufferers from injury with or without tendency to exaggerate their symptoms.

(*b*) Honest sufferers who are mistaken in their claims; e. g., a markedly arterio-sclerotic laborer fell while standing on the sidewalk. He was found to be hemiplegic.

Despite the fact that he was arterio-sclerotic when employed, and was and had been under no physical or mental strain just before the attack, it is difficult to convince him that his is not an "injury" within the meaning of the law.

B, suffering with left epididymitis, insisted that his condition was

due to lifting a table plate even after his gonorrhea was demonstrated to him and after his stout denial of venereal infection.

(*c*) Men who actually have been injured have recovered completely, or with slight disability, and have returned to the performance of their full duties and receipt of full pay.

When discharged because of inefficiency, or when furloughed because of lack of funds, these men almost invariably file a claim for compensation.

(*d*) *Malingerers.*—The feigning of incapacity because of alleged injury is frequently seen; e. g., X, a powerful laborer, alleged a "strain" to his back and consumed considerable working time in coming to the dispensary during work hours and telling his story with variations. At length he was told to report on the following day for an X-ray study of his back.

Stress was laid on the power of the X-ray to finally discover whether basis existed for the alleged symptoms. He failed to report for X-ray examination, and although months have elapsed he has not been seen since about the dispensary.

The medical officer must consider each of these classes most carefully, bearing in mind his obligation to do justice toward employee and employer as well.

His acumen and professional ability are taxed to the utmost at times to deal fairly by both, for the records made at the time of the accident, illness, or alleged disability may years later become the determining evidence for or against a claim for real or alleged compensable injury.

The medical officer's records, then, are of prime importance, and they should show any evidence of contributory negligence. It is required that an employee injured in the line of duty shall report immediately for treatment.

Failure to do so should be regarded as contributory negligence. I think of two men at present permanently incapacitated as result of deep palmar suppuration of the right hand following trivial injury. The injury was neglected, became infected, received such treatment as the individual's family physician gave after the infection developed, and the infection extended to the palm with consequent serious impairment of function.

The original report of injury should be as nearly complete as possible.

All cases of fracture or suspected fracture should be X-rayed at time of injury, and, upon discharge from treatment, for record. A statement of functional result should be recorded, and reported to the Compensation Commission. Especial care should be exercised in recording the exact location of the injury.

It is the duty of the medical officer to consult a specialist in cases where such services are indicated. Usually this should be done with prior approval of the Compensation Commission, and the specialist's bill should be certified by the medical officer.

If necessity for prosthesis arises, it is his duty to see that such prosthesis as is authorized by the Employees' Compensation Commission, is supplied, is suitable, is properly fitted, and that the dealer's bill is duly certified for payment.

The medical officer is required to fill out the "attending physician's statement" on the application of the injured employee for compensation. He is also required to examine and report from time to time the exact status of persons drawing continuing compensation for disability.

When an injured employee declines to accept available treatment offered by the United States, it is the duty of the medical officer to make full, frank and friendly explanation to the injured person, informing him of his rights, and that the law requires that treatment shall be furnished by the United States medical officers, if practicable. The injured man should also be informed that charges for medical and hospital treatment legally cannot be paid if such medical, surgical and hospital treatment can be furnished by the United States as required by the Employees' Compensation Act.

The cost of compensation for partial and complete disability, temporary and permanent, is steadily increasing as a result of accidents and injuries.

It is the medical officer's duty to do all he can to reduce the number of accidents and injuries by inspections, instruction, bulletins, elimination of bacterial and animal infections and animal infestations, general hygienic and sanitary measures, and safety devices.

A man totally and permanently disabled at the age of twenty-five years may live to sixty-five or more years of age. Supposing that he lives forty years, his compensation alone will have cost the United States $32,000, omitting all other considerations. Money might better be spent on accident and injury prevention than upon compensation.

Some forward-looking industrial plants have adopted a system of annual bonus, or increased compensation, for all men in supervisory capacity. The bonus is a possible increase of wages attainable by them in proportion to occurrence of disability for injury among the group of men under their supervision or direction. Checkage is made according to an established scale against the maximum attainable bonus.

I recommended adoption of such a system by the Navy Department in the following letter:

NAVY YARD, NORFOLK, VA.,
26 *November*, 1921.

From: Medical Officer of the Yard.
To: Commandant.
Subject: Safety Precaution and Accident Prevention.

1. Attached hereto is a rough analysis of the accidents which have occurred in this Navy Yard between January 1, and November 1, 1921.

2. The undersigned is unaware of the existence of collated data from which comparisons of results of efforts at accident prevention in the navy yards may be made.

3. It is recommended that:

(*a*) Uniform methods be adopted for reporting accidents, time lost, and compensation paid.

(*b*) A trophy be offered to the yard showing highest degree of excellence annually, as expressed by results of safety effort and accident prevention.

(*c*) A small annual bonus per capita of men supervised be offered to masters, foremen, leading men, and quartermen, and that accidents occurring under their supervision be charged against the maximum bonus obtainable by those having supervision.

At one large plant where the bonus system was in vogue:

"Of the 320 employees eligible to the bonus or additional compensation for safety activities last year, 273 participated in the bonus, and 194 of these 273 were 100 per cent or had no accidents charged to them for the year. These 194 individuals directed the operations of approximately 3,214 employees, working 10,027,680 hours during the year without a single lost time accident."

4. The trophy mentioned in paragraph 3 (*b*) would stimulate yard effort, and the bonus system would encourage effort along safety lines within the yards by making supervising men safety workers at their various stations.

5. As stated above, the undersigned has insufficient data with which to make comparisons, but believes that this navy yard (at which effort is being commenced in earnest) is far behind the industrial plants making best efforts along safety lines, and feels that the introduction of competition may even stimulate other navy yards where safety efforts may be better conducted than at this yard.

(Signed) JAMES C. PRYOR.

One total disability of forty years' duration would pay one hundred and sixty annual bonuses of $200 each, and this might prevent many more total or partial permanent disabilities with the corresponding compensation expenditure.

In conclusion, it might be said that the Employees' Compensation Act has added considerably to the duties of the medical officer by extending his professional services to a population not previously under his care, and *ipso facto* has materially increased his responsibilities to the taxpayers of the United States.

SOME REMARKS ON TESTS FOR CURE OF SYPHILIS

By Major GUY L. QUALLS and Captain ALBERTO G. de QUEVEDO
Medical Corps, United States Army, Station Hospital, Camp Gaillard, Canal Zone

THE *Medico Military Review*, an official publication of the Surgeon General's Office, Vol. V, No. 2, July 15, 1921, states in part: "With our present knowledge of the early localization of spirochetes of syphilis in the nervous system, it is imperative that no case of syphilis of any kind be dismissed from observation without an examination of the cerebrospinal fluid." From our own observation we are entirely in accord with this statement, while a careful review of the literature would we believe convince one not particularly interested in the subject of syphilis of the correctness of the above statement, and the importance of the procedure.

The present standard of "cure" as given by the *Medico Military Review* is as follows: "One year of observation must elapse after all treatment has been stopped. During this year there must be no clinical evidence of syphilis, several negative Wassermann reactions and no positive ones. At the end of the year a complete physical and laboratory examination including that of the spinal fluid and a provocative blood Wassermann reaction must be negative. If all these requirements have been fulfilled the case can be closed as cured and the register sent in."

Gray (1) in a recent article has demonstrated latent neuro-syphilis in 8 per cent of medical patients ignored owing to neglect of spinal puncture.

Tests for cure in syphilis are undertaken for two primary reasons: First, the danger of transmission of the disease to others; second, the treatment to cure, if possible, any latent focus of infection.

That patients with latent or clinically inactive syphilis are capable of infecting others has been demonstrated. Engman and Eberson (2) found the organisms in the lymph glands in three out of fourteen cases of latent lues and in two out of seventeen specimens of seminal fluid. Feldman (3) has shown transmission of infection in a case recently reported by him in this instance, the latent syphilitic having been symptomless for seven years.

At present we have under observation a young husband with a history of syphilis four years ago. Wassermann persistently negative, and he does not have clinical manifestations of syphilis. This man was married nine months ago. During the past month his wife gave birth to a dead syphilitic fetus. His wife's blood at present shows a double plus reaction. This is one of several similar cases under observation by us during the past year.

One of us (Qualls) while on duty at Ancon Hospital, 1916–17, had the opportunity of performing the test for cure on nine soldiers upon whom careful records had been kept, see Table 1. None of these cases at the time of test showed any clinical evidence of active syphilis. The diagnosis in all of them had been established by clinical manifestations, double plus blood Wassermann reaction or both. In each case they had been free from clinical manifestations for one year and had not been given treatment so far as was known for a like period. Several negative blood Wassermann reactions and without positive ones were of record. A control Wassermann test was made on the blood serum prior to the provocative Wassermann. A short synopsis of the syphilitic history is given in Table 1. Their reaction to luetin, furnished by Dr. Noguchi was also studied. In six of these cases, or 66.6 per cent, all tests for cure including luetin were negative. In one case the luetin only was positive, this reaction occurring when other tests were negative and was a late pustular torpid form showing as a pustule on the fifteenth day after injection. In two cases the blood showed a double plus provocative Wassermann test, one of which also showed a pustular luetin reaction. One of these cases denied a primary lesion, two contracted syphilis in Panama, the remaining were contracted in various parts of the United States.

During the time that these cases were under observation, five cases entered the hospital with cerebrospinal syphilis. Since they demonstrate clearly that a negative serum Wassermann or a negative serum provocative Wassermann may be very misleading as far as serious lesions of the central nervous system are concerned, one of them is reported here. They further demonstrate the necessity of a spinal puncture if a correct diagnosis is to be arrived at and logical treatment given.

Private T. M., Co. K, 29th Infantry, age 25, gave the following history: Sore on prepuce, July, 1916. Contracted at Camp Gaillard, C. Z., August 24, 1916, diffuse macular rash and general lymphadenopathy. On December 6, 1916, examination showed partial paralysis, right side of face; difficulty in closing right eye; slightly deaf, right ear; right side of face smooth, left side wrinkled. States that when he becomes heated from walking he staggers as though he was intoxicated. Knee jerks slightly increased, no Rhomberg, pupils react to light and accommodation, slight twitching of left upper eyelid. February 16, 1917, patient entered Ancon Hospital for treatment with the above clinical signs of cerebrospinal syphilis exaggerated. His blood Wassermann was negative; provocative blood Wassermann was persistently negative. His spinal fluid Wassermann was persistently double plus

until he had received five doses of mercurialized serum and one dose of salvarsan. The globulins in the spinal fluid were much increased, as evidenced by butyric acid and ammonium sulphate tests. The colloidal gold shows a typical syphilitic curve and the cell count varied from 20 to 50 per cm. The remaining cases showing persistent negative blood serum provocative Wassermanns and positive evidences of cerebrospinal syphilis as indicated by clinical manifestations and spinal fluid findings are similar in many respects and it is considered unnecessary to report them.

Spinal punctures cannot always be performed in accordance with the wishes of the clinician or at some certain period or interval of observation and treatment of this disease, due to the fact that the patient is not available and not due to any pathology which would contraindicate the procedure at any stage.

Comparisons of Tables 1 *and* 2.—The spirochetes of syphilis localize during the early septicemia stages and apparently not later. Spinal puncture performed at any time after the septicemia provided the necessary tests are accomplished will probably reveal, if present, syphilis in the central nervous system. For this reason two of the cases shown in Table 2 were done before the lapse of one year after the discontinuance of all treatment and are published here as a matter of comparison. (See cases 23 and 24.)

Table 2 presents 30 cases on which the standard of cure has been performed and two cases for comparative study. (See cases 23 and 24.) In all cases except Nos. 23 and 24 treatment has been discontinued for more than a year during which time there were several negative and no positive Wassermanns. In all cases except No. 5 there have been no clinical manifestations during the past year which could be traced to syphilis. Case 5, at the time tests were done, showed a definite Rhomberg slightly axaxic, walks with a wide base, shows weakness in muscles of both hands and spinal fluid cell count is 141. Other tests on his spinal fluid appear negative as is also the provocative Wassermann of the blood serum. This case requires further study before a definite cause for the above-mentioned findings can be ascertained. All except one are native Porto Ricans. There is a definite history of infections having been contracted in Porto Rico in 29. In three cases infection was incurred in Panama.

In the cases presented in Table 2 the total length of active treatment in weeks may be determined approximately by adding the number of intravenous injections of salvarsan and number of mercurial injections. The dose of salvarsan varied depending upon the clinical manifestations and serological results. The dose of mercury salicylate given intra-

muscular varied from one half to one grain depending on the tolerance. Urine examinations were made for manifestations of toxicity which were not present in these series.

In all cases a blood serum Wassermann was done as a check, the day before the provocative test was made. Of the thirty cases for cure, there was not a positive provocative blood serum Wassermann or a positive spinal fluid Wassermann. The cell counts in all except case 5, which was 141, were within normal range, taking into consideration the other negative spinal fluid findings. In eleven cases the ammonium sulphate for globulin showed a plus reaction while in twenty cases the phenol test was plus and in two cases double plus. One of the double plus reactions was contaminated with blood. The colloidal gold in all cases was considered normal. Luetin tests were not made in any of these cases in Table 2 since it has been discontinued in favor of the spinal fluid and provocative blood tests (4). In view of the fact that one case giving a double plus phenol reaction was contaminated with blood and that the other cases with a double plus or plus phenol or ammonium sulphate test were negative in other respects, we are of the opinion that the reactions, so far as they might indicate syphilis of the central nervous system, may be disregarded.

In case 5 with spinal fluid cell count of 141 with clinical evidences of cerebrospinal syphilis cannot be regarded as a cure. It is uncommon, however, to have a cell count so high with negative results from all of the tests as is found in this case. We believe that the remaining twenty-nine cases, in conformity with the army standards, must be regarded as "cure." This gives the percentage of cures of 96.6 per cent, which is a marked contrast to the 66.6 per cent, as shown in Table 1.

The reasons for this contrast cannot at present be definitely determined in these series. The syphilitic registers indicate that the cases had upon an average about the same clinical manifestations when the diagnosis was made; also similar methods of treatment had been employed. Twenty-nine of the cases in Table 2 were contracted in Porto Rico, three were contracted in Panama. Those in Table 1 were contracted in the States or Panama. It is highly probable that an attenuated strain of syphilis exists in Porto Rico or one that localizes less frequently in the central nervous system or that they are comparatively immune to syphilis. Out of our 200 Porto Ricans treated at Camp Gaillard, C. Z., we have only seen three cases of cerebrospinal syphilis, one of which is reported in Table 2, one was a hereditary case in a child three months old, and the other an adult who contracted his infection in New York.

Tests for Cure and Their Relative Importance.—The tests which

TABLE 1

No.	Age	Nativity	Place contracted	Lesions at time of diagnosis	Blood		Tests for cure		
					Wassermann at time of diagnosis or during treatment	Wassermann before test for cure	Provocative blood Wassermann	Luetin	Spinal fluid Wassermann
1	40	Germany	Denies	General maculo eruption, mucous patches, mouth, general lymphadenopathy	XX	...	...	...	...
2	38	U. S.	Omaha	Chancre, prepuce, and alopecia	XX	...	XX	...	...
3	42	U. S.	Buffalo	Chancre, prepuce Wassermann XX.	XX	...	...	...	...
4	33	Germany	New Orleans	Macular rash, general Lymphadenopathy, mucous patches, mouth	XX	...	...	Positive	...
5	24	U. S.	Panama	Mucous patches, throat	XX	...	...	...	...
6	28	U. S.	New York	General lymphadenopathy, penile chancre	XX	...	...	...	...
7	36	U. S.	Buffalo	Sore on penis, Wassermann XX	XX	...	XX	Positive	...
8	35	U. S.	Panama	Chancre, frenum	XX	...	...	...	...
9	30	U. S.	Panama	Pains in tibae at night, inguinal adenitis, synovitis, right knee, headaches.	X	...	...	...	...

TABLE 2

No.	Age	Nativity	Place contracted	Lesions at time of diagnosis	Treatment			Tests for cure				
					Blood Wassermann at time of diagnosis or during treatment	Salvarsan injections (intravenous)	Mercury salicylate (intramuscular)	Phenol spinal fluid	Butyric spinal fluid	Ammonium sulphate spinal fluid	Spinal cell count	Colloidal gold
1	28	P. R. . .	P. R.	Inguinal adenitis, bilateral Wassermann XX.	XX	6	8	X	....	....	13	1111000000
2	24	P. R. . .	Panama . .	Alopecia, history positive.	XX	2	8	X	....	....	10	0000000000
3	27	P. R. . .	P. R.	General lymphadenopathy, chancre penis, Wassermann XX.	XX	6	6	X	....	....	12	0001100000
4	28	P. R. . .	P. R.	Pauplo macular eruption.	XX	6	6	....	X	....	5	0111000000
5	22	P. R. . .	P. R.	Chancre, prepuce, Wassermann XX. .	XX	1	10	....	....	....	141	0000000000
6	24	P. R. . .	P. R.	Chancre, prepuce.	XX	13	12	....	....	....	11	0011100000
7	26	P. R. . .	P. R.	Chancre, prepuce.	XX	6	6	X	....	....	3	0000000000
8	24	P. R. . .	P. R.	General lymphadenopathy, chancre prepuce Wassermann XX.	XX	4	4	....	....	....	5	0111000000
9	21	P. R. . .	P. R.	Maculo-papular eruptions, generalized	XX	6	6	XX	Contaminated with blood			....
10	26	P. R. . .	P. R.	Chancre, prepuce.	XX	3	25	X	X	....	6	0111000000
11	22	P. R. . .	P. R.	Chancre, prepuce.	XX	6	6	X	....	....	10	1222100000
12	25	P. R. . .	P. R.	Chancre, prepuce, Wassermann XX. .	XX	2	8	X	....	X	10	0011000000
13	25	P. R. . .	P. R.	Chancre, prepuce.	XX	7	12	X	....	X	12	0121100000
14	24	P. R. . .	P. R.	Generalized pains, Wassermann XX. .	XX	4	3	X	....	X	3	0011000000
15	23	U. S. . . .	Panama . .	Chancre, of lip, Wassermann XX. . . .	XX	6	8	X	....	....	7	1222100000
16	32	P. R. . .	P. R.	Wassermann XX, clinically negative. .	XX	3	18	X	....	X	10	0011000000
17	25	P. R. . .	P. R.	Chancre, prepuce, maculo papular eruption.	XX	3	10	X	....	X	15	0111000000
18	26	P. R. . .	P. R.	Wassermann XX, clinically negative.	XX	0	24	X	....	....	14	1121000000
19	55	P. R. . .	P. R.	Wassermann XX, clinically negative. .	XX	0	26	X	....	X	12	0122110000
20	24	P. R. . .	P. R.	Wassermann XX, clinically negative. .	XX	6	6	XX	....	X	9	0122100000
21	35	P. R. . .	P. R.	Headaches, Wassermann XX.	XX	4	0	X	....	....	6	0123311000
22	25	P. R. . .	P. R.	Wassermann XX, clinically negative. .	XX	4	4	....	....	....	3	0011000000
23	22	P. R. . .	P. R.	Maculo papular eruption, general lymphadenopathy.	XX	15	12	X	....	....	6	0111000000
24	25	P. R. . .	P. R.	Wassermann XX, History positive. . .	XX	9	13	X	....	....	10	0111000000
25	25	P. R. . .	P. R.	Chancre, prepuce, Wassermann XX. .	XX	3	14	X	....	X	4	0011100000
26	24	P. R. . .	P. R.	History positive, Wassermann XX. . .	XX	3	12	X	....	....	3	0111000000
27	21	P. R. . .	P. R.	Headaches, Wassermann XX.	XX	3	9	X	....	X	5	1122110000
28	25	P. R. . .	P. R.	History positive, Wassermann XX. . .	XX	5	4	....	....	....	10	0111000000
29	32	P. R. . .	P. R.	History positive, Wassermann XX. . .	XX	6	6	....	....	....	2	0011100000
30	28	P. R. . .	Panama . .	Wassermann XX, clinically negative.	XX	7	10	....	....	....	6	0011100000
31	22	P. R. . .	P. R.	Chancre, prepuce, Wassermann XX. .	XX	6	7	X	....	....	5	0111000000
32	29	P. R. . .	P. R.	Papular eruption.	XX	4	26	X	....	X	4	0122100000

have been used and are now in use to determine the cure of syphilis are;

1. Physical examination.
2. Wassermann blood serum.
3. Provocative Wassermann of blood serum. (Tests to be taken 24, 48 and 72 hours and a week after the provocative administration of salvarsan.)
4. Wassermann spinal fluid.
5. Globulin tests on spinal fluid.
6. Cell counts on spinal fluid.
7. Colloidal gold curves on spinal fluid.
8. Luetin intradermic tests.

The blood serum Wassermann, together with the physical examination during the early treatment of syphilis with salvarsan, was advocated by some as a test for cure but was dropped almost as soon as advocated. At present it can only be recommended as a control for treatment when considered with clinical findings.

The provocative blood Wassermann, if negative, cannot be considered by itself as a test for cure, since in some cases, as the five cases of neurosyphilis mentioned above; although serious lesions of the central nervous system were present, the provocative Wassermann was persistently negative.

A double plus Wassermann of the spinal fluid indicates the presence of central nervous syphilis. A double plus Wassermann, however, does not indicate the type or the prognosis. For example, it may be strongly double plus in paresis or gumma or weak plus in some forms of tabes, syphilitic meningitis or vice versa or even negative in some instances.

Globulin tests used in these series are those of phenol and ammonium sulphate, and, I am informed by laboratory workers, are very delicate. An increased globulin is not in itself diagnostic of syphilis but indicative of meningeal inflammation or irritation combined in conjunction with other tests; they may be valuable indicators among tests for cure.

The spinal fluid cell count is a valuable aid in the diagnosis of cerebrospinal syphilis when considered with other tests. It is of value also as to the type of infection, its location and in many instances is a guide to prognosis and treatment. The normal number of white cells present should not be above 12.

The colloidal gold curve is not only a valuable aid in the diagnosis of syphilis of the central nervous system but is useful in the differentiation of the various types. In the differentiation of types it is invaluable in some cases from a prognostic standpoint.

The luetin test as a routine test has been practically abandoned in

the Army for the reason that satisfactory samples have not been secured.

The value of these tests for "cure" when considered together, is without doubt, very important, and when one or two of them are persistently positive with a positive history of syphilis, the case should not be pronounced cured or treatment disregarded.

The physical examination should never be neglected (the more thorough the better) before the various other tests for cure are undertaken. Physical manifestations of syphilis with a positive history unless the lesion can be definitely demonstrated to be other than syphilis is a certain indicator for further treatment.

We should all remember that only a few years ago the physical examination and history was all the profession had to depend upon, and, at that, the manner in which syphilis was managed by the profession at that time was highly commendatory.

SUMMARY

In this series thirty-nine tests for cure have been performed, twenty-nine cases are native Porto Ricans and ten on soldiers born in the United States and contracting syphilis there. In the Porto Rican troops the percentage of "Cures" is 96.6 per cent, and in the American troops the percentage is 66.6 per cent.

It is highly probable, in the cases of Porto Ricans, that they were in most instances infected with an organism of low virulence, slight invasive or localizing power or that they are relatively immune. One of us (de Quevedo) has observed that there are comparatively few tabetics or paretics in Porto Rico.

It would not be logical to predict the disappearance of syphilis in man, however; if all cases could be treated to cure, it would be easy to imagine it as a rare disease among the more civilized nations in the course of three or four generations.

A negative provocative blood Wassermann should never be accepted as a cure. Many cases of active destructive lesions of the central nervous system may exist and the provocative Wassermann be persistently negative.

In that two cases were not observed for one year after treatment was discontinued, tests for cure, however, are considered negative, the question arises: Could not cure in many cases be determined before the lapse of one year? Only future work can determine this question.

Tests for cure should be given in all cases with a positive history of syphilis in which marriage is contemplated, and, if not found free from syphilis, marriage should be delayed until cured. Tests for cure should be performed upon all soldiers with a positive record of syphilis in which

the infection has become latent, the patient notified of his condition and referred for treatment if found positive.

Only by this system of follow up or a similar one can it be determined whether the neuro-syphilitic is ever cured or whether certain forms of the latent neurosyphilide of today becomes the paretic or the tabetic in the future.

We are indebted to the staff of the Board of Health laboratory at Ancon, Canal Zone, by whom most of the laboratory tests on these cases were performed, and to Capt. Joseph F. Gallagher, Medical Corps, for making the butyric acid tests and performing the cell counts on the spinal fluids.

BIBLIOGRAPHY

(1) Gray, H.: American Journal of the Medical Sciences, Vol. clxiii, No. 3, pp. 384–390, June, 1921.

(2) Engman and Eberson: quoted by Feldman, New York Medical Journal and Medical Record, Vol. cxv, No. 9, May 3, 1922, pp. 512.

(3) Feldman, Samuel: New York Medical Journal and Medical Record, Vol. cxv, No. 9, pp. 512 and 513, May 3, 1922.

(4) Nicholls, H. J.: Major, Medical Corps, Personal communication.

NEUROSYPHILIS[1]

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IN THE past few years there has been an ever-increasing attention to the various phases of syphilis. This has been accompanied by a realization not only of the seriousness of the disease itself but of the part it bears in aggravating or producing other processes, and in particular its effects upon the nervous system.

Even prior to the war the military services were cognizant of the prevalence of the disease, some observers estimating that from 18 to 22½ per cent of the population are syphilitic. With the vast clinical opportunities presented during the war activities these conclusions were substantiated.

In the insane 20 per cent of the admissions will show a positive Wassermann reaction of the blood serum. In a survey at St. Elizabeth's Hospital, Washington, D. C., excluding the known syphilitics, 20 per cent of the patients examined showed a positive blood test.

In a series of 1,183 autopsies at the Central Islip State Hospital, New York, syphilis appeared as a primary or contributory cause of death in 5 per cent. In 73 of 322 cases of cerebral syphilis the primary cause was attributed to some other condition, as pneumonia, tuberculosis, chronic nephritis and exhaustion. Of 190 cases of tuberculosis, 19 occurred in combination with paresis; in these the primary cause of death was given as tuberculosis. Of five cases of cancer of the breast, one was accompanied by paresis.

Of the 1,183 autopsies, in the original death certificate the primary causes of death, according to the International List, was stated as cerebral syphilis in 30 cases, and general paresis a contributory cause in 238 cases, and syphilis in 65 more, a grand total of 625 cases in the 1,183 autopsies.

Utilizing the Wassermann reaction as a criterion of the incidence of syphilis reveals interesting statistics. In apparently normal individuals, and in those with disease not due to syphilis, positive reactions occurred as follows:

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[1]Read at the 30th Annual Meeting of The Association of Military Surgeons of the United States, Washington, D. C., October 12-14, 1922.

	No. of cases	*Per cent of positive Wassermann's*
Apparently normal adults	200	24
Apparently normal children	52	95
Patients with pulmonary tuberculosis	60	23
Patients with typhoid fever	13	22
Patients with malaria	7	12
Patients with dysentery	12	20
Patients with pneumonia	30	30
Patients with pellagra	22	13
Patients with cancer	17	12
General average of		32 per cent

In patients suffering with conditions which may be caused by syphilis the following results were obtained:

	No. of cases	*Per cent of positive Wassermann's*
Patients with arteriosclerosis	18	23
Patients with chronic interstitial nephritis	4	25
Patients with diffuse interstitial nephritis	60	48
Patients with paralysis	34	50
Patients with myocarditis	21	40
Patients with cirrhosis of liver	6	60
Patients with bone and joint pains	30	80
General average of group		40 per cent.

By undermining the resistance of the individual, syphilis allows infection with tuberculosis. No doubt, the favorable results obtained by Wright of the Navy in the treatment of tuberculosis with mercury were due to overcoming the syphilitic element present.

A word of caution must be expressed in regard to the proper valuation to be placed upon the Wassermann reaction in diagnosis. In the last word the diagnosis should depend upon the clinical symptoms. If this fails, in very recent cases or in mixed chancres it must be made by demonstration of the treponemata. The diagnostic injection of salvarsan or the use of luetin is of no value.

The Wassermann test is specific for active or reactivated syphilis, but complement fixation is not. Colloids similar to those of syphilis may be produced by other morbid processes, especially those caused by protozoa. A two or four plus reaction obtained with four or five antigens and different methods is positive proof of syphilis particularly if a small quantity of serum is used.

Partial and doubtful reactions may be produced by malaria, leprosy, pneumonia, tuberculosis, cancer, exophthalmic goiter and other conditions such as pregnancy and alcoholism.

The All-American Conference on Venereal Diseases agreed that a frank, reliable Wassermann reaction is evidence of syphilis with the following limitations: (1) In the absence of history and a positive reaction alone the diagnosis should be made with great care, and the test should be verified by another serologist. (2) A weak reaction should not be accepted as diagnostic but calls for further investigation. (3) A negative reaction cannot be regarded as proof of the absence of syphilis. (4) Cholesterinized antigen makes the test very sensitive and is of value in determining treatment. (5) A negative reaction is no indication for stopping treatment. Overtreatment in early syphilis destroys the patient's protective substances. A positive complement fixation test in the later stages should not be regarded as indicating the presence of active organisms nor as a signal to prescribe treatment.

Treatment of syphilis, however drastic, cannot be relied upon to produce a permanently negative complement fixation test. The complement fixation test is useless as an indicator of cure or as a regulator of treatment.

There is no doubt that the Wassermann reaction, properly done, is our most valuable single factor in the determination of syphilis. However, it should be estimated as any other symptom and not regarded as conclusive.

The considerable disagreement regarding the reaction has had a tendency to bring it into unmerited disrepute. This has been due largely to the evident unreliability of the serologic reactions, as usually performed and interpreted, and has been particularly true in their utilization to decide and govern treatment. Supposed reliable laboratories submit reports on identical specimens which disagree, and these not in degree but actually as to fact; that is, whether positive or negative. This condition is probably due to many factors participating in those reactions of which we are unaware. It may be that laboratory workers in these praiseworthy efforts to simplify methods invalidate the test.

There have been repeated alterations of the principle originally evolved. The innumerable modifications have reduced the percentage of negatively reacting sera, ignoring the margin of safety. This condition is unfortunate, as it has served to deteriorate a valuable clinical adjunct. By drawing the serum reaction too fine it is possible to get a positive where syphilis is not present. In such cases great damage is done to the individual. It is almost impossible to convince a patient that he has not syphilis after he has once been made aware of a positive reaction. He tends to develop a syphilophobia.

Once the diagnosis is made, to the general practitioner upon whom

devolves the care of the syphilitic there is the responsibility of seeing that the disease is adequately treated, so as to assure the prevention of recurrences and the onset of those disorders to which syphilis tends, and especially to obviate the neurosyphilitic involvements. Five per cent of syphilitics develop syphilis of the nervous system. It is believed that this has been increased since the advent of intensive arsenical treatment; however, this is debatable.

As yet a standard syphilitic treatment has not been attained. The best method will be that which yields consistent and permanent results with the least possible harm to the patient. When damage occurs it is most liable to be to the structures of the nervous system.

Treatment should be commenced, if possible, in the prepositive Wassermann stage, the diagnosis being made upon the dark field examination. It should be continued until the findings at all levels are rendered reliably negative. No patient should be discharged until a final estimate of the spinal fluid has been made. If the fluid shows a negative Wassermann, it may be inferred reasonably that the infection has been handled successfully.

The reaction of the blood serum is no criterion, as it may be negative in neurosyphilis. The colloidal gold test is of particular value, but it must be carefully and competently done to be so considered.

In neurosyphilis, we can never state positively that a cure has been made. All patients should have continued supervision, with laboratory checkages at regular intervals for years. The best that can be hoped for is control.

It is too soon to conclude that the neurologic complications of syphilis have been lessened by intensive treatment. It is possible that the nerve structures are damaged by large doses of arsenic. It is well known that arsenic has a selective action on nerve tissue, as indicated by arsenical neuritis and encephalitis and the many occurrences of optic damage following arsenical treatment.

The untoward effects of arsenic may be due to allergic idiosyncrasy, anaphylaxis, protoplasmic sensitization from repeated doses, or the nitritoid reaction due to the destruction of treponemata, thus liberating large quantities of protein substances to which the tissues have become sensitized.

We are still unaware as to what actually determines the involvement of the neurologic structure in syphilis. There are a number of factors which may influence the onset of these disorders, alcoholism, trauma, overwork, sexual excess, emotion, in fact anything which impairs the resistance of the cerebrospinal system may be responsible. It is also possible that the nerve tissue of the individual is predisposed.

Another consideration is that there may be different strains of treponemata and that one of these is neurotrophic.

In the intensive use of arsenicals, because of their selective action on nerve tissue, there may be some damage done to these structures, at least an impairment of their resistance, if not actual solution of their integrity. This may be sufficient to allow invasion of the brain and cord by those organisms of the disease which escape the initial treatment. The toxicity of the arsenic is possibly augmented by the benzyl component in some of the preparations used.

Another factor of damage is that, as a result of treatment, there is evidently caused what may be likened to a negative phase, the Herxheimer reaction, due to the stimulating activity of nonsterilizing doses of arsenic.

No doubt some involvement of the nervous system occurs coincidently with the secondaries. In cerebrospinal syphilis there are active luetic lesions of the meninges and vessels of the brain and cord. In paresis and tabes dorsalis the parenchyma of these organs has been invaded by the treponemata at sites more or less remote from the blood vessels. This condition presents a hopeless prognosis for cure, as it is impossible to reach these areas because of the inability of the medicaments to permeate the capillary walls.

Eliminating those cases in which there occurs the well-recognized remissions regardless of treatment, treatment will only be of ultimate value in cases where the parenchyma has not been involved; here it should be utilized to the utmost.

Examination of the spinal fluid is all important in the treatment of syphilis. There is no similarity between early symptoms and spinal fluid findings which can be relied upon as a guide to the advisability of examining the spinal fluid. Therefore this should be done routinely. However, spinal puncture should not be done in primary cases, early or late, without a preliminary sterilization of the blood stream by several injections of arsphenamin to prevent a possible transfer of organisms to the meninges.

The routine of the spinal fluid early in the first course of treatment, after the second or third injections of arsphenamin will give a valuable guide to the therapeutic indications in each case. It is more valuable than later examinations of the fluid.

Intensive treatment of incipient neurosyphilis within the first two years causes a rapid and marked response in most cases.

The earliest change in the spinal fluid in secondary syphilis is the rise in the cell count evidencing meningeal reaction. This is followed by an increase in globulin and finally a positive Wassermann reaction if large amounts of fluid are used.

Symptoms and signs must be regarded as late rather than early manifestations of involvement of the nervous system. Only 16 per cent of early cases will show symptoms as against 53 per cent in late secondary cases.

A patient with early syphilis should not be discharged from a first course of treatment or placed upon mercury alone without examination of the spinal fluid. Slight changes in the fluid indicate meningeal involvement which may cause a neuro-recurrence if treatment is relaxed or suspended. Insufficient treatment causes severe recurrences in the vital organs, since on account of the little formation of immune bodies in organs with poor blood supply the organisms remain unattacked and later on become active because too little resistance has been built up. This applies particularly to the nervous system.

Cases in which the spinal fluid is normal during the early secondary period show a distinct immunity from subsequent involvement, especially if effective treatment is carried out. Neurosyphilitic involvement apparently takes place comparatively early in the course of the disease. A proportion of from 40 to 50 per cent will have a normal spinal fluid at all stages.

A proportion of patients, varying from 5 to 8 per cent in early, and from 14 to 41 per cent in late syphilis, will present negative Wassermann reactions in the blood and positive spinal fluids. The proportion of patients with this important combination will vary in different series, with the duration of the infection, previous treatment and class of patients.

As a syphilitic infection progresses from the early to the late stages, and as the form of the involvement gives rise to symptoms, the neurosyphilitic changes assume increasing importance. The examination of the spinal fluid is often necessary to reveal underlying syphilis, because where only 40 per cent of blood may be positive, the spinal fluid will be so in 70 per cent.

The examination of the spinal fluid is a simple procedure, and therefore recourse should be had to this measure more often. In a series of over 2,500 punctures there have been no unfavorable effects and very little inconvenience and practically no pain.

It seems advisable to say a few words regarding the diagnosis of syphilitic involvement of the nervous system, as it is very important to realize when this has occurred. This is especially true in the case of paresis. Here we aim at the singling out of the cases of diffuse parenchymatous syphilis with preponderance of the loss of the tangenital fibers and other nervous structures, with neurologic overgrowth, disorganization of the lamellation of the cortex, and infiltration of the

sheaths of the small and medium vessels with plasma cells, and occasional local devastations. Paresis is an invasion of the brain by treponemata with parenchymatous reaction and a more or less incidental mesoblastic response.

By the diagnosis of paresis we mean the distinctive formulation of facts which are clinched by the concept of progressive parenchymatous syphilis of the brain, in distinction from other progressive reductions of the brain, and conditions resembling such a process, or in distinction from processes which are not progressive, and perhaps not even evidence, of distinct brain damage.

The problem becomes a difficult one where we deal with processes also on a syphilitic basis but with a different type of lesion, the diffuse syphilitic meningitis or gummatous processes, the syphilitic vascular effection of the smaller vessels and the tabetic conditions with non-paralytic psychoses. It also causes considerable perplexity when we deal with a patient with evidence of syphilis and symptoms of neurasthenia, arteriosclerosis, senility, epilepsy, alcoholism, multiple sclerosis or functional psychoses. In these latter cases it is decided by the characteristic disorganization of the personality and the cardinal findings in the spinal fluid. In importance these rank as follows:

1. The Wassermann reaction.

2. The colloidal gold test, if it involves the total discoloration of the first five dilutions, and relative discolorations of the dilutions 6, 7, and 8.

3. The presence of globulin either in the form of the first phase of the Nonne-Apelt or with Noguchi's butyric acid, or the Ross Jones test.

4. The presence of more than 10 or 12 cells per cmm., especially where there are all plasma cells and no leucocytes.

The cerebral symptom complex of paresis is conclusive where diffuse cerebral symptoms and certain eye symptoms combine with the specific parasyphilitic signs. The eye symptoms are irregular, unequal, sluggish and Argyll-Robertson pupils.

The speech disorder, the writing disorder, tremor, difficulty of coordination and of relaxation and overflow, enervation, exaggeration of tendon reflexes with ankle clonus, but rarely with Babinski's sign, at times with the combination of exaggeration of reflexes and hypotonia, more or less typical cerebral attacks of the character of apoplectiform or epileptoid reactions usually appearing in the form of status, with prolonged coma and with varying but usually not lasting Jacksonian focal symptoms, especially epileptoid states of bewilderment and amnesia or fuges, rarely clean cut epileptic attacks.

Evidence in the mental functions and progressive loss of memory,

changes of the personality, indifference to the discrepancies of duties and memory, lapses of behavior, variable emotionality and suggestibility, euphoria, and certain superimposed reactions of predilection such as the exalted polypraxia or the absurd hypochondriacal states. It is especially important to realize that there is no symptom complex from neurasthenia, hysteria, delirium or manic depressive and paranoic reactions which would as such exclude the possibility of paresis; on the other hand a number of these can be complicated by signs of nervous instability which might simulate paresis.

REFERENCES

(1) Public Health Reports, U. S. P. H. S., Dec. 30, 1921.

(2) Krauss, William: The Whys and Wherefores of Unreliable Wassermann Reports. Southern Medical Journal, Vol. xiv, No. 3, March, 1921, p. 186.

(3) Stokes and McFarland: Comparative Observations in Involvement of the Nervous System in Various Phases of Syphilis. The American Journal of Syphilis, April, 1922.

(4) Meyer A.: Differential Diagnosis of General Paresis. Transactions American Medical Psychological Association, 1917.

(5) Fordyce, J. A.: The Importance of Recognizing and Treating Neurosyphilis in the Early Period of the Infection. The American Journal of the Medical Sciences, Vol. clxi, No. 3.

(6) Moore, J. E.: The Cerebrospinal Fluid in Treated Syphilis. J. A. M. A., Vol. 76, p. 769, March 17, 1922.

(7) Martin, J. F.: Arsphenamin Reactions. J. A. M. A., May 1, 1922.

(8) Sheehan, R.: Remarks on the Neurology of Syphilis. MILITARY SURGEON, September, 1921.

(9) Rost, C. A.: The Treatment of Early Syphilis. Klin. Wochenschr., 1: 129, 175, 223, January 15, 21, 28, 1922.

(10) Carter, H. G.: Pulmonary Tuberculosis and Syphilis. Virginia Medical Monthly, Vol. 48, p. 553, January, 1922.

(11) Andronis, A.: Importance of Early Diagnosis and Treatment of Syphilis. Texas State Journal of Medicine, Vol. 17, p. 428, January, 1922.

(12) Dreyfuss, B. L.: Prognosis in Syphilitic Pupillary Disturbances. Medici. Klinic. Berlin, Vol. 17, p. 1541.

(13) Moore, J. E.: The Classification, Treatment and Prognosis of Early Asymptomatic Neurosyphilis. Bulletin of Johns Hopkins Hospital, July, 1922.

A POSSIBLE FALLACY IN THE CALCULATION OF ANNUAL DEATH RATES

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(With one chart)

ANNUAL rates per thousand for deaths and for the incidence of disease are used in public health work, both civil and military, for the purpose of comparing conditions of disease and of mortality in different communities or commands. To be of value for such a purpose the rate should be such as to represent as truly as possible the actual relative standing of the communities compared in the matter studied. In the ordinary civil community the matter of the death rate, for instance, is a simple one. The total number of deaths for the year in the community or in any specific age or sex group of the population, is divided by the number of persons of the corresponding group living in the community as determined by census or intercensal estimate. The variation in population from month to month is usually small in proportion to the total and has little effect on the calculated rates. It has been customary to calculate annual rates per thousand in the army by the same method, dividing the total deaths by the number of thousands of strength, taking the average of the monthly strengths, that is, the mean annual strength as the population. In armies varying greatly in strength from month to month, however, this method of estimating the rate fails to produce figures that are fairly comparable. As an example of this situation, take for example the United States Army in Europe during the year 1918, and the Army in the United States during the same period. The A. E. F. varied enormously in monthly strength, its maximum nearly ten times its minimum. The Army at home varied considerably but not to nearly so great a degree. Let us suppose for purposes of illustration a condition which did not obtain. Let us suppose that these two groups of the Army had been affected by exactly the same death rate each month of the year. It is beyond question that, had such been the case, the force of mortality in the two commands would have been the same. Table I illustrates this supposed condition. The figures for the strengths of the two groups are taken from the Report of the Surgeon General, United States Army, for 1919. The rates applied for purposes of illustration are those of the army in Europe. The table shows that with these rates the Army at home would have had 16,673 deaths, which on a mean annual strength of 1,310,242 men gives a rate per thousand for the year of 12.72. With the same rates each month the A. E. F. had 15,939 deaths which on a mean annual strength of 999,680 gives an

annual rate of 15.94, a difference of 3.14 in the rates as calculated by the usually accepted method. Since the rate for each month was assumed to be the same for the two groups it is obvious that, if our method is a correct one, the annual rates should also be the same. Since this is not the case, and since the force of mortality throughout the year was obviously the same for the two groups, it follows that the figure used for the annual rate is not the correct one.

The basis of this error is the fact that, in commands of varying strength, the year is too long a period on which to figure rates on a basis of average strength. This is especially true when there is the enormous variation in death rates from month to month that was true of 1918. However, for strict comparative purposes the same error exists to some extent with the usual seasonal variations in death rates if the strength of a command shows considerable variations.

Fundamentally the health conditions of a community are the summation of the conditions occurring from month to month. It is self-evident that, if two communities have the same death rate each month for a year, they should show the same annual death rate. Conversely, if on comparison of the monthly rates of two communities we find those of one consistently higher than those of the other, it is evident that the conditions in the one are conducive to a greater proportion of deaths than is true of the other. A truly satisfactory comparative annual rate therefore must be such a rate that, if applied to the mean strength of a command or average population of a community, will show a number of deaths equal to the sum of the deaths resulting from the application of the monthly rates to the same mean strength. In other words, it represents the number of deaths per thousand that would have occurred in a community of the same population, which remained constant throughout the year and which was affected by the same monthly death rates as the command or community being studied. In the case of the A. E. F., for instance, the true rate is the rate that expresses the number of deaths that would have occurred in a command of 999,680 men, constant throughout the year, which had each month the same monthly rate as was shown by the A. E. F. This rate is the average of the monthly rates, in this case 12.01 per 1,000, for the year. This rate is, of course, the same for the Army at home in the assumed case. It thus represents the fact that, as shown by the identity of the monthly rates, the force of mortality in the two commands was the same. While this is entirely an assumed case, it shows that the rate calculated from the total deaths and the mean strength in the two groups is not a comparative figure and is therefore worthless for the purpose for which the rate is used. The conditions in the Army in 1918, the coincidence of maxi-

mum strength with the enormous death rate of the influenza epidemic have served to bring out this discrepancy markedly.

It is possible still further to illustrate the action of these factors on rates by assuming a series of imaginary commands, each of a mean annual strength of 100,000 men. To the first, Camp A, which like a civil community remained at a uniform strength of 100,000 throughout the year, we will apply the death rates per month that were shown by white enlisted men in the A. E. F. Table II shows that these rates correspond to a total number of deaths for the year of 889, an annual death rate on the mean strength of 8.89. The average of the monthly rates gives the same figure. This again brings out the fact that when the strength remains constant the use of the usually accepted annual rate is without objection. The second of our imaginary camps also had a mean annual strength of 100,000, but it varied greatly from month to month in such a way that the strength was greatest during the months that also showed the highest death rates. The figures resulting in this second camp, Camp B, are shown in Table III. Here again the same monthly rates prevailed as in Camp A. Therefore the fundamental conditions throughout the year must have been the same for the two camps. Examination of the table however shows that while Camp A had only 889 deaths during the year, Camp B, with exactly the same death rates month by month, had 1,308 deaths, which would give an annual rate of 13.08 per thousand on the mean strength. The average of the monthly rates of course remains the same for the two camps, and is obviously preferable as a basis of comparison between the two. A third camp, Camp C, had its strength so distributed throughout the year that with the same mean of 100,000 the greater strength came during the months of lower rates. This camp shows only 787 deaths and an annual rate on the mean strength of 7.87. Again the average of the monthly rates remains the same as in the other camps (Table IV). While these examples have perhaps been of extreme variations in strength, they illustrate the principle involved, and the distribution of the strength in Camp B is not unlike that shown in Table I for the A. E. F.

We have thus seen that it is possible to have three camps having the same mean annual strength, and the same death rates month by month, which have greatly varying numbers of deaths for the year and correspondingly varied annual death rates as ordinarily computed. In all three, however, the force of mortality must have been the same as the monthly rates were identical. It is obvious, therefore, that the annual rate as ordinarily calculated is worthless for comparative purposes as between such camps.

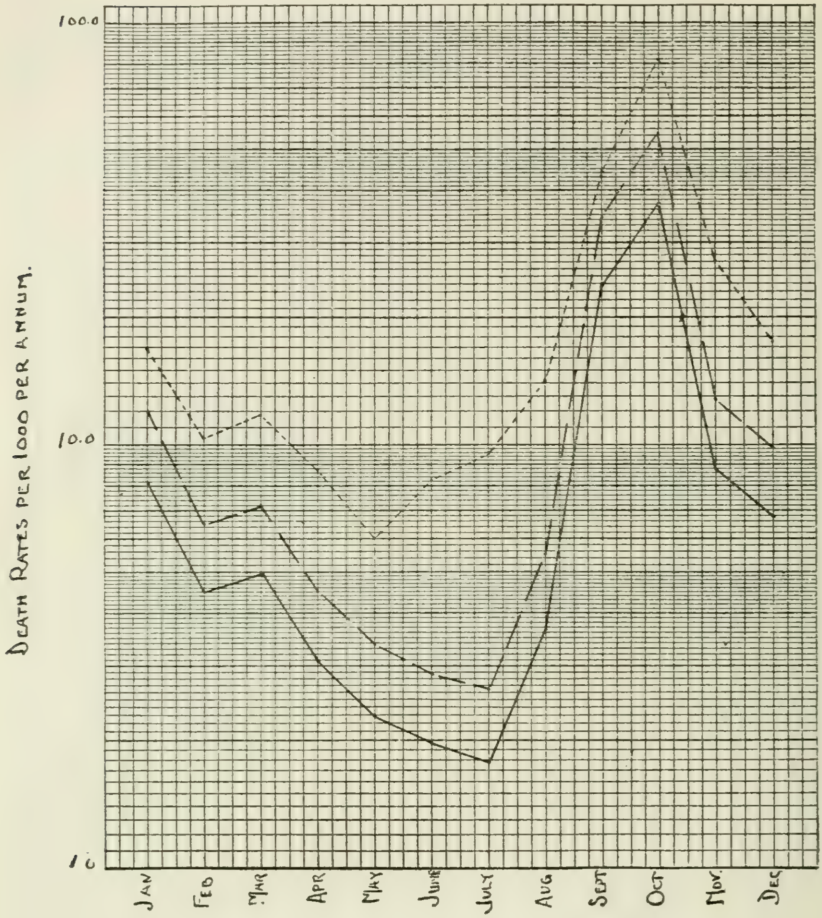

FIG. 1.—Graphic comparison of death rates for Camps B, D, and E, by months.
Camp B— Camp D— Camp E—

It is equally possible to show that three camps may have the same mean annual strength and the same total number of deaths for the year, and yet have a greatly varying force of mortality. Camps B, D and E show how this may result from differences in the monthly distribution of the population (Tables III, V and VI). Each camp has a mean annual strength of 100,000 men. Each shows 1,308 deaths. Yet the monthly rates vary widely. Fig. 1 shows graphically the relations of the monthly rates for the three camps. It is seen that throughout the year the rates for Camp B were lower that those of Camp D, while those of Camp E were consistently higher. It is apparent that the force of mortality in the three camps was not the

same. Yet they show identical annual death rates as ordinarily computed. Again, however, the mean of the monthly rates furnishes a satisfactory basis of comparison. Camp B thus shows a rate of 8.89, Camp D of 13.08, and Camp E one of 21.20. That these more nearly represent the relative conditions of the three camps as shown in Fig. 1 is hardly debatable.

The influence of these factors on comparisons between commands may be further illustrated by consideration of the death rates for the group of respiratory diseases shown by two of the army camps in 1918. Camp Travis, Tex., which had a population that varied but little, had its greatest strength in the month of the influenza epidemic. Camp Wheeler, Ga., had its lowest point in the same month, with the exception of the month of December. The report of the Surgeon General for 1919 gives the death rates for white enlisted men, total respiratory diseases, for Camp Travis, 10.04; for Camp Wheeler, 8.28. The means of the monthly rates, however, reverse the positions of the two camps, giving Travis 10.11 and Wheeler 11.25. In view of the considerations stated above there can be no doubt that the latter figures represent the true relation of the camps.

We have shown that when the strength of a command varies greatly from month to month the annual rate per thousand as ordinarily computed fails to give a rate fairly comparable with those of commands of constant strength. It follows that such rates are not comparable with those of civil communities, based as they are on nearly constant populations from month to month. In comparing the rates for the Army during the war to those of the population that remained at home, this fact should be borne in mind. This is particularly true of the total death rate for disease and of the rates for the respiratory diseases because of the influence of the influenza epidemic at a time when the strength of the Army was at its greatest.

A satisfactory death rate for comparative purposes must be a rate which, when applied to the average strength of a command for a year, shows the same number of deaths as would have occurred in a command of the same strength, constant throughout the year, affected by the observed monthly death rates. In commands of greatly varying strength from month to month the annual rate as ordinarily computed does not meet this definition. The mean of the rates by month does meet it. Therefore for comparative purposes—and death rates are computed for the purpose of comparison—the mean of the monthly rates is the correct figure to use. In such commands the annual rate, as computed from the total number of deaths and the mean annual strength, is worthless.

TABLE I.—Showing the Effect of Applying the Same Monthly Death Rates to Commands of Varying Monthly Strength. The Figures for Strength are Those of the U. S. Army in Europe, Enlisted Men Only, 1918, and the Corresponding Strengths for the Army in the U. S.

U. S. Army in the United States. Enlisted Men

Month	*Strength*	*Ann. death rate per 1000*	*Deaths*
January	1,147,639	12.07	1,153
February	1,138,670	6.96	660
March	1,180,024	8.22	808
April	1,224,684	4.79	489
May	1,271,800	3.92	416
June	1,392,533	3.73	433
July	1,447,575	2.79	336
August	1,452,139	4.71	570
September	1,497,315	28.81	3,595
October	1,522,046	48.82	6,197
November	1,402,264	11.05	1,292
December	1,046,224	8.30	724
Total	15,722,913	144.17	16,673
Mean	1,310,242	12.01	

Annual death rate per 1,000 calculated from total deaths and mean strength, 12.72.

U. S. Army in Europe

Month	*Strength*	*Ann. death rate per 1,000*	*Deaths*
January	201,937	12.07	202
February	232,794	6.96	135
March	294,809	8.22	202
April	400,715	4.79	160
May	615,519	3.92	201
June	829,835	3.73	258
July	1,110,863	2.79	258
August	1,345,326	4.71	528
September	1,619,063	28.81	3,887
October	1,774,148	48.82	7,217
November	1,831,515	11.05	1,685
December	1,740,334	8.30	1,204
Total	11,996,658	114.17	15,939
Mean	999,680	12.01	

Annual death rate per 1,000 calculated from total deaths and mean strength, 15.94.

TABLE II.—Showing the Identity of the Mean Annual Rate as Usually Computed with the Mean of the Monthly Rates is a Command of Constant Strength Throughout the Year.

Camp A

Month	*Strength*	*Annual rate per 1,000*	*Deaths*
January	100,000	8.14	68
February	100,000	4.47	37
March	100,000	5.00	41
April	100,000	3.09	26
May	100,000	2.27	19
June	100,000	1.97	16
July	100,000	1.77	15
August	100,000	3.68	31
September	100,000	23.72	198
October	100,000	37.16	309
November	100,000	8.75	73
December	100,000	6.77	56
Total	1,200,000	106.79	889
Mean	100,000	8.89	

Annual rate computed from total deaths and mean annual strength, 8.89.

TABLE III.—Showing the Effect of a Change in the Distribution of Monthly Strength on a Command of the Same Mean Strength as That in Camp A. In this Case the Strength is so Distributed that the Greater Strength and the Higher Death Rates Coincide.

Camp B

Month	*Strength*	*Annual rate per 1,000*	*Deaths*
January	10,000	8.14	7
February	20,000	4.47	7
March	40,000	5.00	17
April	50,000	3.09	13
May	60,000	2.27	11
June	80,000	1.97	13
July	90,000	1.77	14
August	120,000	3.68	37
September	170,000	23.72	337
October	200,000	37.16	618
November	190,000	8.75	139
December	170,000	6.77	95
Total	1,200,000	106.79	1,308
Mean	100,000	8.89	

Annual rate computed from total deaths and mean strength, 13.08.

TABLE IV.—Showing the Effect of a Change in the Distribution of Monthly Strength on a Command of the Same Mean Strength as Camp A. In this Case the Strength is so Distributed that the Greater Strength and the Lower Death Rates Coincide.

Camp C

Month	*Strength*	*Annual rate per 1,000*	*Deaths*
January	10,000	8.14	7
February	40,000	4.47	15
March	80,000	5.00	34
April	90,000	3.09	23
May	120,000	2.27	23
June	170,000	1.97	27
July	200,000	1.77	30
August	190,000	3.68	59
September	170,000	23.72	336
October	60,000	37.16	185
November	50,000	8.75	37
December	20,000	6.77	11
Total	1,200,000	106.79	787
Mean	100,000	8.89	

Annual rate computed from total deaths and mean annual strength, 7.87.

TABLE V.—Showing the Monthly Rates Necessary to Give the Same Number of Deaths as Was Shown in Camp B, when the Strength Remains the Same Throughout the Year.

Camp D

Month	*Strength*	*Annual rate per 1,000*	*Deaths*
January	100,000	12.00	100
February	100,000	6.49	54
March	100,000	7.29	60
April	100,000	4.56	38
May	100,000	3.36	28
June	100,000	2.88	24
July	100,000	2.64	22
August	100,000	5.52	46
September	100,000	34.92	291
October	100,000	54.60	456
November	100,000	12.84	107
December	100,000	9.85	82
Total	1,200,000	156.84	1,308
Mean	100,000	13.08	

Annual rate computed from total deaths and mean annual strength, 13.08.

TABLE VI.—Showing the Monthly Rates Necessary to Give the Same Number of Deaths Shown in Camp B, when the Strength is Distributed so that the Greater Strength and the Lower Rates Coincide.

	Camp E		
Month	*Strength*	*Annual rates per 1,000*	*Deaths*
January	170,000	16.90	239
February	190,000	10.30	163
March	200,000	11.70	196
April	170,000	8.71	122
May	120,000	6.00	60
June	90,000	8.27	62
July	80,000	9.45	63
August	60,000	14.01	70
September	40,000	44.40	148
October	10,000	81.60	68
November	20,000	27.00	45
December	50,000	17.29	72
Total	1,200,000	255.63	1,308
Mean	100,000	21.29	

Annual rate computed from total number of deaths and mean annual strength, 13.08.

SOME OF THE MEDICAL CONTRIBUTIONS OF LINNAEUS[1]

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LINNAEUS exists in the minds of most people as a great botanist—as the man who introduced system in the classification of plants. His work in zoology is fairly well known, but his contributions to medicine are but little known, at least in the medical profession. He was early thrown into close association with members of the medical profession, and it seems from a study of his biography that at critical moments in his life the helping hand was the hand of a physician. When his father had determined to apprentice him to a tradesman, Rothman, a physician of Wexio, took the boy into his own home and furnished him with books on botany and physiology. Dr. Celsius, of Upsala, engaged him as an assistant in botany and helped him to obtain private pupils; and Dr. Moraeus, of Fahlun, influenced him to study medicine. These are all-important events in the early life of Linnaeus, and it is to the credit of the medical profession that it contained men who appreciated the worth of the young man and gave him substantial aid.

The object of this article is to call attention to his more important medical works and in particular to his very interesting study on the classification of diseases. Linnaeus had already done notable work in botany when he decided to go to Holland to study medicine at the suggestion of Dr. Moraeus, whose daughter he later married. He chose, as his school, the Medical College of Hardeswyck.

It does not seem that he was especially enthusiastic as a student of medicine. Botany took the greater part of his attention; physic was the study of his leisure hours. However, when it came to graduation he chose for his thesis a new hypothesis of the causes of the intermitting fevers of cold climates, especially those of his own country. In this dissertation he assigns as one of the principal causes, the water impregnated with argillous (clayey) substances—an hypothesis, as one of his biographers states, "he took pains to render valid by many arguments and ingenious asservations." These, Baeck says, "make one willing to credit the author, though the principal point might still be subject to doubt." He later on modified his views. After his examination and public defense of his thesis, Linnaeus obtained on June 24, in the twenty-eighth year of his age, the degree he sought for. Van Gorter expressed himself as follows on his diploma: "The undersigned does certify that

[1]Read before the Science Club, University of North Dakota, November 21, 1922.

he has remarked in the learned Swede, now doctor of physic, Charles Linnaeus, uncommon knowledge and erudition, not only in the different branches of physic but also in botany."

Before returning to Sweden he desired to see some of Holland's noted men. He accordingly went to Leyden, where he met Van Swieten, one of the great pupils of Boerhaave; Lieberkuhn from Berlin, then a student at Leyden and celebrated later for his microscopic work; Isaac Lawson, a Scotchman; and Dr. John Gronov.

The most eminent man then at Leyden was Herman Boerhaave, the great physician, whom Linnaeus for a long time sought in vain to see. Owing to Boerhaave's immense practice and his strict regularity, ambassadors, princes, and even Peter the Great, were obliged to wait their turn to obtain an interview. In addition it was quite necessary to give the servants a *douceur* in order to gain entrance. Linnaeus finally obtained admittance by sending the great physician a copy of his "Systema Natura" then just published. He was called to meet Boerhaave at his villa, where he was warmly welcomed by the aged physician. He made such a good impression that he was urged to stay in Holland and received a letter of introduction to Burman, then professor of botany in Amsterdam, with whom he remained until the spring of 1736, when another opportunity presented itself.

George Cliffort, burgomaster of Amsterdam and one of the directors of the Dutch East India Company, was a most zealous lover of the natural sciences and possessed a magnificent botanical garden at Hartecamp. Boerhaave was his physician and on an occasion gave him the following advice: "You have plenty of everything, yet there is one thing alone you have not got to render your life completely happy. You are accustomed to live high, hence you are so frequently troubled with hypochondriac complaints. You must keep a physician of your own to prescribe and order your diet, and to take daily care of your health—in cases of a more serious nature he may consult me."

"Well proposed," replied Cliffort, "but where shall I find such a clever and skilful man?"

"Never mind, this I shall make my own business. I know a young man, who is now at Amsterdam; it is him I shall recommend as the best to answer your purposes. Besides, he is also an excellent botanist and will arrange your garden at Hartecamp."

Linnaeus could not wish for anything better and gladly accepted.

In the summer of 1736 he visited England and there met Sir Hans Sloane, the founder of the British Museum, and a pupil of Sydenham. He was a very prominent physician of his time and in addition was highly respected for his philanthropy and patriotism. He readily permitted

Linnaeus to see his cabinet and his collection of near two hundred and fifty divisions. Besides Sloane, Linnaeus saw, while in England, Dillenius, professor of botany at Oxford, Miller, and several others.

Of prominent French scientists and physicians of the times he gained the friendship of several, among them Bernard, and Anthony de Jussieu, and De Sauvages, of Montpelier, the author of a classification of diseases.

Boerhaave, who thus far had been the author of his good fortune in Holland, recommended him for the position of physician in ordinary in the Dutch colony at Surinam, but this was not accepted. Boerhaave's regard for Linnaeus was most high, and when admitted to the sick chamber of the great physician to take his final leave, the venerable man uttered these significant words: "I have lived my time out, and my days are at an end. I have done everything that was in my power. May God protect thee with whom this duty remains. What the world has required of me it has got, but from thee it expects much more. Farewell, my dear Linnaeus."

In 1738–39, on his return to Stockholm, he began to practice. At first patients were few in number, but later he seems to have had plenty to do, as is indicated in a letter to Haller: "Aesculapius affords all that is good, but Flora yields but Siegesbecks." Siegesbecks, a pupil of Heister, had published some criticisms on his classification of plants. Heister, a man distinguished for his knowledge of anatomy and surgery but, as Stoever, says "unskilful in his knowledge of botany," was also an opponent of Linnaeus.

Linnaeus' medical work in Stockholm began to attract attention. He was appointed physician to the fleet and later botanist to the king. In addition he was allowed to perform a number of autopsies. In 1741 came his appointment to the professorship of physic and anatomy at Upsala, in the thirty-fourth year of his age. A year later he exchanged chairs with Rosen, the professor of botany—an advantage to both.

Although his position was now that of professor of botany he did not lose his interest in his old vocation. From time to time he contributed articles which were of distinct value to the medical profession, and, considering the status of medical knowledge at the time, placed him with the advanced thinkers in medicine. At this time medicine was in a most confused state. It was the age of systems and theories, the result, to a certain degree, of the active work going on in the as yet immature sciences. Enough stimulation had come from the newer methods of scientific study to render the leaders in medical thought dissatisfied with the then existing method of classification. Sydenham, some years before the time of Linnaeus, had pointed out the advantages of a systematic nosology in these words: "It would be a very good thing if all

the diseases were reduced to definite and certain species with as much accuracy as the botanists have done with descriptions of plants." In 1731 De Sauvages had published a paper classifying diseases according to their symptoms and causes. In this classification there were eleven classes, forty-four orders and three hundred and fourteen species.

Having met with great success in his classification of plants, Linnaeus turned his attention to the classification of diseases. His period of practice and experience gained at autopsies no doubt furnished him with valuable data as a basis for his work. The result of this study was his "Genera Morborum," published in 1759, and in some respects his most important medical publication. In it he divides diseases into Classes, Orders, and Species, in much the same way as in his classification of plants. There are eleven Classes, thirty-seven Orders, and three hundred and twenty-five Species. Symptoms are largely the basis of the work; the groups *Deformes* and *Vitia* represent anatomic forms. De Sauvages, in a later edition of his work, is said to have incorporated in his classification some of the features of Linnaeus' method.

MORBI

Febriles (e sanguine in medullam)			EXANTHEMATICI.	I.
			CRITICI.	II.
			PHLOGISTICI.	III.
Morbi (Temperati)	Nervii...	Sensationis	DOLOROSI.	IV.
		Judicii	MENTALIS.	V.
		Motus....	QUIETALES.	VI.
			MOTORII.	VII.
	Fluidi Secretionis.....		SUPPRESSORII.	VIII.
			EVACUATORII.	IX.
	Solidi...	Interni......	DEFORMES.	X.
		Externi.....	VITIA.	XI.

EXANTHEMATICI. Febris cum efflorescentia cutis maculata.
CRITICI. Febris cum urinae hypostasi lateritia.
PHLOGISTICI. Febris cum pulsu duro, dolore topico.
DOLOROSI. Doloris sensatio.
MENTALES. Judicii alienatio.
QUIETALES. Motus abolitio.
MOROTII. Motus involuntarius.
SUPPRESSORII. Meatuum impeditio.
EVACUATORII. Fluidorum evacuatio.
DEFORMES. Solidorum facies mutata.
VITIA. Externa palpabilia.

LINNAEUS' CLASSIFICATION OF DISEASES

The first three classes are characterized by fever, but the three groups differ from each other in certain respects which give them their names.

I. The first class, *Exanthematici* (*Febris cum efflorescentia cutis*

maculata), he divides into *contagiosi*, *sporadici*, and *solitarii*. The "*contagiosi*" contains six diseases; among these, variola, rubeola, and syphilis. The group "*sporadici*" contains three diseases: miliaria, uredo, and aphtha. The group "*solitarii*" is represented by one disease, namely erysipelas.

II. The second class is the *Critici* (*Febris cum urinae hypostasi lateritia*). This contains three orders: (1) *continentes*, (2) *intermittentes*, and (3) *exacerbantes*. The names of these types are self-explanatory.

III. The third class, and likewise the third variety of fevers, is the *Phlogistici*, characterized by hard pulse and local pain. This class is divided into three orders: (1) *membranacii*, (2) *parenchymatici*, and (3) *musculosi*. There are seven diseases described under the "*membranacii*"; as examples may be mentioned pleuritis and cystitis. Under the "*parenchymatici*" are described seven diseases, all inflammations of organs except one, namely, cynanche, described as "*inflammatio faucis*." Other diseases put under this heading are hepatitis, splenitis, and nephritis. Only one disease is described under "*musculosi*," namely, phlegmon.

IV. The fourth class is the *Dolorosi*, divided into two orders, the *intrinseci* and *extrinseci*. This class includes pain in different parts of the body not associated with any other particular symptom; as, for example, under the "*intrinseci*" there are described ophthalmia, otalgia, and nephralgia. These are characterized simply as "*oculi dolor*," "*auris dolor*," and "*renis dolor*." Twenty species of disease are described under the "*intrinseci*."

Under the "extrinseci" are described five diseases, among which are arthritis and pruritus.

V. *Mentales*, the fifth class, is characterized as "judicii alienatio." There are three orders under this heading: *idealis*, *imaginarii*, and *pathetici*. Seven species of diseases are described under "idealis," five under "imaginarii," and twelve under "pathetici." Mental diseases like delirium, mania, and melancholia are classed under "*idealis*"; panophobia and hypochondriasis under "*imaginarii*"; bulimia, polydipsia, satyriasis and hydrophobia under "*pathetici*."

VI. The sixth class is *Quietales*, defined as "motus abolitio." It includes three orders: *defectivi*, *soporosi*, and *privativi*. There are six species of disease under "defectivi," examples of which are lassitude, asthenia, and syncope. There are ten species under "soporosi," among which are somnolentia, apoplexy, paraplegia and stupor. The order "privativi" includes fifteen species, which represent, especially, defects in the various sensory apparatuses, but also a few other defects such as amentia ("*imaginationis defectus*"), amnesia ("*memoriae defectus*"), aphonia ("*loquelae privatio*"), and atony (*fibrarum muscularium con-*

tractionis defectus"). As examples of sensory defects are classed amblyopia, cataract, paracusis, and anosmia.

VII. The seventh class is the *Motorii.* Under this are included two orders: *spastici* and *agitatorii.* Ten species are found under the "*spastici*"; among these, spasms, trismus, and tetanus. Fifteen species are found under "*agitatorii*"; tremor, subsultus, chorea, and epilepsy may be mentioned.

VIII. *Suppressorii* (*Meatum impeditio*). This class is divided into two orders: *suffocatorii* and *constrictorii.* Under "*suffocatorii*" are included conditions which interfere directly or indirectly with respiration or the voice, or the abnormal functioning of parts involved in respiration and the use of the voice. There are eighteen species under this order. The following may serve as examples: hoarseness ("*raucedo*"), sighing ("*suspirium*"), yawning ("*oscitatio*"), snoring "(*stertor*"), dyspnoea, and asthma.

The order "*constrictorii*" is a small group. All except two represent involvement of the genito-urinary and gastro-intestinal tracts. These two are aglutition ("*deglutitio impedita*") and agalactia "(*lactis defectus*"). Among the other may be mentioned obstipation, dysmenorrhea, and sterility.

IX. *Evacuatorii* (*Fluidorum evacuatio*). This class is divided into five orders: *capitis, thoracis, abdominis, genitalium,* and *corporis externi.* "*Capitis*" includes six species, among which are otorrhea, hemorrhagia, coryza, and ptyalism. "*Thoracis*" contains four species: hawking ("*screatus*"), expectoration, hemoptysis, vomica. "*Abdominis*" contains fourteen species: ructus ("*rejectio flateum frequens*"), nausea, vomitus, diarrhea, dysentery, and tenesmus, may serve as types. The order "*genitalium*" contains eleven species, all representing genito-urinary disorders; as representative of this group may be mentioned diabetes, hematuria, gonorrhea, menorrhagia, parturition, and abortion. The fifth order under "*Evacuatorii*" is "*corporis externi.*" There are only two species under this heading, namely, galactorrhea ("*lactis effluxus*") and sweating ("*sudor*").

X. Deformes (*Solidorum facies mutata*). This is divided into three orders: *emaciantes, tumidosi,* and *decolores.* The "*emaciantes*" includes five species: phthisis, tabes, atrophia, marasmus and rachitis. The order "*tumidosi*" includes eight species, all characterized by more or less swelling. Among these there are mentioned polysarcia, anasarca, hydrocephalus, ascites and tympanitis. "*Decolores*" includes five species: cachexia, chlorosis, scorbutus, ictericus and plethora.

XI. Vitia (*Externa palpabilia*). This is the largest class in the "Genera Morborum," both in number of orders and species of disease.

It is divided into eight orders: *humoralia, dialytica, exulcerationes, scabies, tumores, procidentiae, deformationes,* and *maculae.*

"*Humoralia*" contains nine species; as representatives may be mentioned emphysema, oedema, inflammation, abscess, and gangrene.

The second order, "*dialytica*" ("*solutiones continuii*"), contains fourteen species, their predominating characteristics being indicated as above described. Fractures, rupture, contusions, tingling, burning, and chapping are typical representatives.

The third order is "*exulcerationes*" ("*suppurationes apertae*"), containing thirteen species. As examples may be mentioned ulcers, noma, carcinoma, ozena (which is described as "*ulcus intra antrum Highmore*"), caries, and paronychia.

The fourth order is "*scabies.*" Under this heading were included formerly a great variety of skin lesions totally different from the disease now known by that name. Linnaeus uses the term to designate an order, and the species has nineteen diseases. The more important of these are lepra, tinea, psora, herpes, anthrax, pustule, papule, verruca, clavus, and stye.

The fifth order is "*tumores protuberantes.*" This includes ten species, all characterized by swelling and tumor formation. The more important are aneurisms, varix, scirrhus ("*glandulae endurata*"), struma, anchylosis ("*tumor geniculorum*"), ganglion, and exostosis.

The sixth order is "*procidentiae.*" Eight pathological conditions are spoken of. As examples may be mentioned hernia, prolapse, and ectropium.

The seventh order is "*deformationes.*" This includes eighteen species of deformities. Among these we have contractions, distortions, strabismus, myopia, presbyopia, lagostoma ("*labium superius oris fissum*"), atresia ("*meatus corporis imperforatus*"), hirsuties, and alopecia. As may be seen, a number of conditions are included which now would hardly be classed as deformities.

The eighth, and last, order is "*maculae.*" Under this are put nine species of abnormalities of the skin; cicatrix, maevus, melasma, and lentigo are the more important.

These, then, in brief are the essential points of the "Genera Morborum." In view of the imperfect state of pathology, anatomy, and physiology, the ignorance in regard to the etiology of disease at that time, it is to be considered as a creditable contribution to medicine.

Some of his other medical works and his views on medicine may be mentioned; the most important of these works is his "Clavis Medicinae Duplex Exterior et Interior." This was really a compendium of the whole science, and an epitomical sketch of the virtues and effects of medicines.

Linnaeus also wrote and lectured on the subject of dietetics. "This science," he says in a letter to a friend, in 1774, "is a delight. I have collected more than I know any others to have done." He published a number of treatises on motion, diversity of aliments, edible plants of Sweden, and on numerous other similar subjects.

He recognized the causation of death by the lodgment in the lungs of fibrinous polypi carried in the circulation. He also gave a good description of aphasia, and distinguished between central hemorrhage and congestion.

As evidence of his advanced views on medical subjects may be mentioned that he believed that scabies, epidemic dysentery, pertussis, smallpox, pest, leprosy, pulmonary phthisis, and malarial fever were caused by the entrance of small, living animals into the body.

In 1748 he studied the taenia and reported some new observations, among which was the first description of taenia solium. *Felicis maris* was recommended by him, but evidently this passed unnoticed inasmuch as later, in France, this remedy was sold as a secret to a royal family.

His treatises on Materia Medica placed this branch of medicine on a firm foundation though it did not escape criticism. Vic d'Azyr, secretary of the medical society of Paris, said: "This work is little worthy of its author."

Linnaeus' well-known views on the efficacy of strawberries in gout were published in 1750. He firmly believed that he was cured of the malady by the use of this fruit.

In addition to introducing system into the classification of drugs, he brought to the attention of the profession quassia, solanum, dulcamara, and the importance of various poisons if rightly used.

In this brief and imperfect review of the brilliant career of one of the world's greatest geniuses, it has been possible to point out only in a casual way the items of particular interest to the medical man. Linnaeus is not to be remembered alone as a botanist. His medical works are too important. His name is entitled to a lasting place in the history of medicine. His classification of diseases, his rearrangement of materia medica, his introduction of new drugs, his solid contributions to medical science, his advanced views on the etiology of certain contagious diseases, all these entitle him to enduring fame and honor in the medical profession. Moreover, we may draw a lesson from the study of the life and methods of this great physician-scientist which may be put in his own words taken from a letter to Haller in which he says, referring to his two greatest contemporaries, Haller and Dillenius, "You both have read the same book which I read—you have read Nature."

THE MEDICAL MAN AND THE MEDICAL RESERVE CORPS, U. S. A.[1]

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THE HISTORY of medicine reaches far back into the misty centuries of the remote past, and the study of it is a matter of keen interest to analytic minds. Of like interest is a survey of the genesis and development of medico-military history. From Babylonian, Indian, Egyptian and Hebrew records, we observe that physicians were early found with armies, and that, to a modest degree, care and supervision were extended to the sick and wounded. This procedure was carried forward and continued during both the Greek and Roman dominancies.

The great campaigns of the past were great partly because of the international relationship that enveloped them, partly because of the strategic value either proximal or remote that they wrought, partly because of the forthstanding genius of the great commanders whose names have become classic in military archives. To a very large extent, these several campaigns were carried through by virtue of the offensive weight of great numbers, the crushing impact of brute strength, and a relative superiority of equipment and discipline of the personnel. The man wastage of those days was appalling, but was accorded only scant consideration.

While it is true that Homer records the skill of sundry commanders that had personal skill in the care of the wounded, that he praises the military and surgical skill of the two sons of Aesculapius, and that he puts into the mouth of Nestor the famed lines:

> A Surgeon skilled our wounds to heal
> Is more than armies to the public weal;

true that Xenophon is credited with having carried eight field surgeons with his historic ten thousand; yet it must be fairly admitted that the care of the sick and wounded was of negligible significance in these remote days, even though it be further admitted that priestly ministration, in a medico-surgical capacity, was found recorded from time to time.

A measurable betterment is found when Rome began to achieve imperial dominancy. Dating approximately from Emperor Augustus, we find that the cohorts were allotted four cohort surgeons and that the legions (of ten cohorts) were assigned a legionary surgeon. This is

[1] An address before the Surgical Association of the Rock Island R. R. System, Oklahoma City, Okla., December 6, 1922.

admittedly a generously intelligent allotment, even when gauged by modern standards; furthermore, it seems probable that each trireme carried a physician. Valetudinaria were established with a personnel consisting of male attendants. The physicians and surgeons thus noted were accorded a rank comparable with noncommissioned officers, and a degree of respect and authority proportionate thereto.

The Helvetian policy, typical of the times, regarded the care of their own sick and wounded as a high responsibility, but the wounded of the enemy were slain. With the decline of the Roman Empire medico-military provisions steadily declined in parallel. In the tenth century the distinguished Arabic surgeon Abul Kasem recorded in his classic book his own medico-military experience, but during the succeeding centuries the sick and wounded fared pitiably, cared for by monks from time to time (until prohibited by Papal decree), by barber surgeons, quacks, their own comrades, and the horde of bawds that historically are found battening and spawning in the vicinity of armies.

In England we find recorded in the Domesday Book Manniot and Nigellus, two military surgeons serving twenty years subsequent to the battle of Hastings; but not until approximately 1300 was an effort made to establish anything that approximated a Medical Corps, nevertheless, so late as 1346 the muster roll failed to record any sanitary personnel. Henry V at Agincourt had with his staff a physician, a surgeon, and twelve assistants. But, as a rule, surgeons were for the nobility only, or with men of large means, rather than the rank and file. Charles the Bold of Burgundy (fifteenth century) and Gustavus Adolphus (seventeenth century) assigned surgeons to troops. It is but the bare statement of fact to record that medico-military matters shared the darkness of the Middle Ages, the sense of official or personal responsibility approximated the nadir, and the widespread outworkings of crude charlatanism, shadowy mysticism, and gross quackery found genial soil for abundant fruitage.

The dawn of the Renaissance brought a betterment in this field; boiling oil, and pungent wine, hair, dust, fragmented moss from graveyard skulls, peacock's dung, and red hot irons as wound styptics began to be displaced (largely through the work of Paré) by the ligature; and surgical instruments began to take on configuration and type less akin to the tools of a blacksmith. But it may be mentioned, in passing, that the attractive forms and varieties that have been rescued from the scoriae of Pompeii and Herculaneum were as yet not equaled.

Not until approximately the mid-seventeenth century were regimental surgeons appointed in the English service and accorded a rank equal to the chaplains. Transport wagons were occasionally employed

for the sick and wounded, either relaying them to a nearby town or following the advance of combat troops. At about 1700, regimental medicine chests were provided (heretofore supplies having been largely furnished by the barber-surgeons). The early eighteenth century noted an effort to acquire and train a better type of military surgeons, the necessity of an established medical service became evident, coincident with the according of appropriate respect to military surgeons, and the granting of the right to wear the uniform. In 1783 the custom of purchase and sale of the position of surgeon was forbidden by law. The seventeenth century saw the establishment of military hospitals in garrison towns, which served as bases; a restricted use of mobile hospitals was found in 1700. The genesis of the hospital movement was of necessity both crude and inadequate, but by treaty England and France recognized such as neutral.

The Napoleonic campaigns gave a great stimulus to medico-military matters, more skilled surgeons were engaged, medical staff officers had general oversight of sanitary resources and measures, ambulance wagons began to appear as part of the regimental equipment, the so-called "flying hospital" began about 1810. Larrey was the justly outstanding military surgeon of the French during this period.

In 1815 Jackson (who had been appointed by the Duke of York as Physician of all the Forces) demanded military honors and decorations for his officers, stating that while such titles were irrelevant to scientific men, the common soldier would obey the medical officer better if he possessed rank in the army. This demand of Jackson is today, as it was, essentially sound both in principle and fact, and forms one of the foundation stones upon which modern medico-military procedure is based.

The experience engendered in our Civil War was corroborated by that developed in the Franco-Prussian campaign, i.e., the necessity of a mobile sanitary personnel. England took advantage of such, abandoned her regimental system and gradually substituted therefor a medical staff, bestowing medico-military titles but denying authority commensurate with similar rank in other branches of the service. This blunder was practically overcome by the formation of the Royal Army Medical Corps in 1898. At about 1850, small mobile field hospitals with surgeons, apothecaries and personnel came into use, carts requisitioned from the zone of action transported the sick and wounded, but the Crimean campaign made evident the inadequacy of this method and, as a result, litter-bearer sections made their appearance. At this period the American organization was much like that of the British; but as the result of greater accuracy and augmented range of both

rifles and artillery the danger zone substantially increased in depth, the tactical adjustments that necessarily followed developed a "no man's land" of the wounded, too far behind the advanced line for primary adjustments, too far in advance for the stabilized hospital units. The distinguished Legouest has accurately described the unfortunate hiatus thus created.

To Medical Director Letterman of the Army of the Potomac should be accorded unstinted praise for the well-coordinated plan devised by him, accepted by General McClellan, and later by General Grant for the Army of Tennessee, and yet later approved by Congress and the President in March, 1864. The plan in brief is as follows: An independent ambulance corps with each army corps, equipped with ambulances, litters, supply wagons, and a mounted quota of officers and sergeants; a coordination of the ambulance with the field hospital; exclusive care and responsibility of the sick and wounded vested in the Medical Department; proper military rank and authority for medical officers; the development of sanitary tactics, proved from the beginning a brilliant success, and is, in fact, the foundation upon which has been developed the present Medical Department organization and procedure. It is reasonable to assume that substantial modification will be made from time to time, based largely upon the increasing range of weapons, the conflicting problems introduced by modern toxic gasses, aerial dominancy, the practical scrapping of the provision of the Geneva Convention regarding Medical Department neutrality, the increased danger and length and complexity of the Line of Communication, etc., but it is likewise a fair assumption that the basic principles laid down by Letterman will continue as basic principles of procedure.

The foregoing digest, though of necessity absurdly incomplete, is yet quite adequate to exhibit the interesting and logical development of medico-military affairs. The World War wrought striking changes in the organization and tactical procedures of all the contending forces. It is a matter of pronounced felicitation that the American Expeditionary Forces were not driven into the adoption of static warfare tactics; per contra, by adhering to the traditional American custom of fighting in the open we emerged from the struggle with no essential or vital modification of pre-existing tactical policies.

But though no vital modification of pre-existing tactical policies resulted yet a somewhat more intensive consideration of details will reveal that the army of today is in many ways not the army of yesterday. While the customs and courtesies of the service have not essentially altered, there seems reason to believe that there is a drift toward simplification of method with consequent economy of time and money expendi-

ture, likewise a tendency toward closer cooperation between the different branches of the service made effective by a greater knowledge by any one branch of the duties carried and the demands made upon other branches; the alteration of preexisting armament and the acquisition of new types have increased individual and aggregate destructive efficiency; the basic combat units are not only larger but also more effective, motorization has increased both the daily radius and the speed of all transport agencies, aerial reconnaissance is assured and aerial offensive is progressively in evidence, intelligence is more far-reaching, the care of the sick and wounded has notably advanced, the service of supply has been rendered more dependable, and last, but by no means least, the acquisition of raw materials the infinite basic essentials (afforded either by the home land or garnered through customary commercial channels) and the manufacture of such into forms suitable for military use have attained a level heretofore unknown.[2] But possibly more remarkable and far-reaching in their ultimate results than all these are the Reorganization Plans of the Army, authorized by the War Department, the which, including defense plans, constitute the first definitive defense policy of the United States.

The Reorganization Plans authorized by the War Department, and now being developed in effect, have engendered radical changes, notably the interrelational status accorded to the Regular Army, the National Guard, and the Organized Reserves, as the three coordinated components of the Army of the United States. There have already germinated (and beyond doubt yet others will follow) many interesting problems, the successful solution of which will largely determine the future efficiency and effectiveness of the Army.

"The National Defense Act of 1916, as amended June 4, 1920, provides the United States with a preparedness plan for the first time in her history.[3]

It is the purpose of this paper to describe the army organization plan created by the above mentioned Act of Congress and to make it clear to you that the Officers' Reserve Corps is now being organized with fixed and definite policies as to eligibility, appointment, assignment, promotion, instruction, and as to all the essential details which make for efficiency.

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[2] An interesting analysis of this field has been made by Little, Arthur D., "Natural Resources in Their Relation to Military Supplies," Annual Report Smithsonian Institution, 1919.

[3] It was originally planned to submit liberal extracts from the National Defense Act, and the War Department rulings therefrom outlining the present policy concerning the organized Reserves; in addition the assistance of the Acting Chief of Staff, 102nd Division, was requested to supply all essential, and in particular all up-to-date, W. D. memoranda and data. The subjoined notation, which reached the author within a few hours prior to leaving town, so admirably covered the ground that they were inserted *en bloc*. The occasion is embraced to express cordial appreciation of the unvarying courtesy and valuable cooperation extended by the Acting Chief of Staff, 102nd Division.

The United States Army is now made up of three components: the Regular Army, the National Guard, and the Organized Reserves, including the Officers' Reserve Corps and the Enlisted Reserve Corps. The third component, the Organized Reserves, makes up approximately 80 per cent of the Army.

The National Guard may be called out in minor emergencies for employment within the limits of the United States, by the states or by the United States. The Organized Reserves, on the other hand, constitute purely a war force and can be employed only in the event of a national emergency declared by Congress.

Organization of the Army.—The peace establishment including the Regular Army, the National Guard, and the Organized Reserves is to include all those divisions and other military organizations necessary to form the basis for a complete and immediate mobilization for the national defense in the event of a national emergency declared by Congress. Should it become necessary to mobilize for war, the three components will unite to form one army, harmonious, well balanced and efficient.

For purposes of administration, training, and tactical control the continental area of the United States has been divided on a basis of military population into nine corps areas.

The Seventh Corps Area is a typical example of the operation of this plan. This corps area has been allotted eight states by the War Department, as follows: Missouri, Arkansas, Kansas, Iowa, Nebraska, Minnesota, North Dakota and South Dakota, with headquarters at Omaha, Nebraska.

In this corps area there are three infantry divisions, the 88th, 89th and the 102nd, and a proper proportion of corps, army (including cavalry), auxiliary, and special troops, all of the Organized Reserves.

The 102nd Division has been allotted the states of Missouri and Arkansas. Division Headquarters is located at St. Louis, Mo., Room 408 Old Custom House, 3rd and Olive Streets.

This division was established September 1, 1921, since which date the division has been organized 94.6 per cent complete. However, this is only a beginning toward the requirements of the Organized Reserves in this area for physicians, dentists, and veterinarians, as it takes into account only the needs of the division and leaves out of the reckoning the big item of such nondivisional units as general, evacuation and surgical hospitals, surgical teams, laboratory units, veterinary, general and convalescent hospitals, as well as medical regiments and medical detachments of combat units under the direct control of the War Department.

Under the supervision of Corps Area Headquarters the 102nd Division Headquarters is responsible for the administration, training, and tactical control of the following troops which go to make up the division: two infantry brigades, one field artillery brigade, one regiment of engineers, one medical regiment, one quartermaster train, and the air service. Aggregate strength 19,997. The war strength of each unit of the Organized Reserves is the same as that of the Regular Army. Tables of Organization are identical.

Peace-time strength of the Organized Reserves differs from the war-time strength in that each unit in time of peace is not recruited to full strength as to enlisted men. Each unit is being organized with its war-time quota of officers and noncommissioned officers and with a certain number of enlisted specialists. As a result of this plan, if a declaration of war necessitated the mobilization of the Army, the organized and trained nucleus of every unit would be promptly recruited to full strength and would be able to handle its recruits without delay or confusion. It is obvious that this peace-time plan of organization reduces the labor and expense incident to raising and training the Organized Reserves.

Working Details of the Organization Plan:

Eligibility.—General rule—every male citizen of the United States and the Philippine Islands between the ages of 21 and 60 years.

Eligibility for commission in the Medical Department Reserve—in addition to the above general qualifications, physicians, dentists, and veterinarians are required to be graduates from reputable professional schools, to hold state board licenses to practice, to be in active practice, and to be of good moral and professional standing.

Appointment.—There are three general methods of determining the qualifications of an applicant for appointment: (*a*) Examination of his War Department record, (*b*) attendance at a course of instruction, (*c*) personal examination. The first method applies to persons who have served as officers during the World War. The second method applies to persons qualifying at training camps, to Reserve Officers' Training Corps Students. The third method applies to all persons not included by the first and second methods.

Until November 11, 1923, the examination for appointment of persons who served as officers of the United States Army between April 6, 1917, and June 30, 1919, will consist of an examination of the applicants' military record and a physical examination.

The examination for appointment of those who did not serve as officers during the World War is as follows:

(*a*) Physical examination

(*b*) Basic military subjects
1. Administration.
2. Customs of the Service.
3. Military Hygiene.

(*c*) Professional examination.

The exact operation of this method of appointment is as follows. A local board is appointed by these headquarters to meet at the call of the president of the board for the purpose of examining applicants for commission who may be ordered before it. The president of the board is authorized to arrange a time and place of examination, and the board is given full authority to exercise its discretion in the selection of reserve officers. The following quotations from the Regulations for the Officers' Reserve Corps is given to make it clear that it is not expected that reserve officers upon appointment shall be proficient in all military details of their offices:

It is not to be expected that reserve officers shall at all times be proficient in all military details of their offices, but it is expected that they shall possess those qualities which will enable them to become proficient when the necessity arises. Therefore a candidate for appointment who has the basic qualities and potential possibilities for making an efficient officer will not be rejected for lack of detailed technical military knowledge such as he may acquire in reasonable time after his appointment.

To quote further:

Boards will exercise the discretion given them as to scope and character of examinations to fit the examination in each case to that needed to determine the suitability of the individual candidate for the appointment sought by him.

The professional examination for applicants to the Medical, Dental, and Veterinary Officers' Reserve Corps consists solely in satisfying the local board as to professional qualifications by credentials submitted.

Period of Appointment.—Appointments are for a period of five years.

Reappointment.—Upon the expiration of the period of appointment, a reappointment without change of grade will be tendered automatically by the War Department.

Rank.—Persons who served as officers during the World War upon commission in the Officers' Reserve Corps are entitled to the highest rank held during the war. Persons without World War experience can only receive Reserve Corps commissions in the lowest grade—medical and dental officers as first lieutenants, veterinary officers as second lieutenants.

Assignment.—Every officer is being assigned to a military unit or specific duty which he is expected to perform in time of war and for

which he may be trained in time of peace. These assignments are made after each individual's preference and qualifications have been fully considered to insure the maximum utilization of our man power by so placing each officer that he will be doing that work for which he is best qualified.

Promotions.—In general a reserve officer is eligible for examination for promotion after three years' service in the lower grade; and the former officer is authorized to reckon the time he served between April 6, 1917, and November 11, 1918, as double time toward promotion.

Training and Instruction.—The training and instruction of reserve officers divides broadly into two general classes: First, that received when they are called into active duty for that purpose; second, that received or acquired through individual interest and effort in the intervals between periods of active duty.

The extent of training of the first class cannot exceed fifteen days per year, except with the consent of the individual reserve officer, and is further limited in practice by funds available for pay and other expenses incident to active duty. The policy of the War Department is to interfere as little as possible with the civil occupation of Reserve Officers. The law prevents the assignment of a Reserve Officer to active duty except in time of a national emergency for more than fifteen days a year unless he consents, and the regulations make provision for exemption from active duty at any time when such duty would work a hardship to the officer.

As to training of the second class, a pamphlet entitled "An Announcement of Army Correspondence Courses 1922–1923," is inclosed. It is requested that the marked selections in this pamphlet receive special consideration so that a clear idea of all essential details of this plan of instruction may be gained. Manifestly the average reserve officer will require the correspondence course as a foundation to enable him to take full advantage of the experience of an active training period.

Pay and Allowances.—The following is quoted from Regulations for the Officers' Reserve Corps (Special Regulations No. 43):

> A reserve officer when on active duty shall receive the same pay and allowances as an officer of the Regular Army of the same grade and length of service and mileage from his home to his first station and from his last station to his home, but shall not be entitled to retirement or retired pay. Pay status begins on the date that the officer officially complies with order calling him to active duty and ends when he is relieved from active duty. In time of peace an officer relieved from active duty is entitled to pay during the actual time required to travel from his last station to his home, to be computed over the shortest usually traveled route.

Uniform Regulations.—All reserve officers are required to provide themselves with field uniforms pertaining to their grade. Necessary uniforms and equipment may be purchased from Army Quartermaster depot sales stores in such quantity as needed by each individual for active service.

Extract from a Letter from the Surgeon General of the Army:

We have reason to believe that much has been accomplished in the organization of the Officers' Reserve Corps in placing the matters of appointment, promotion, and assignment upon a uniform and satisfactory basis. Now that we have a definite military policy which calls for the organization in peace time of the Army of the United States consisting of the Regular Army, National Guard, and Organized Reserves, the medical and allied professions should be quick to accept their share in this responsibility for the national defense and become a part of the Medical Department. No mobilization is justified until medical arrangements are made. The organization of the medical service cannot be secondary to any plan of military organization. The mobilization and training of the citizen army up to a certain stage are largely medical problems. The constituted agency for the dissemination of the principles of preventive medicine and their application in the scheme of national defense is the Medical Department Reserve."

The clear thinking man of today differs in no essential from the clear thinking man of yesterday, nor yet from the clear thinking man of the morrow. In each instance the historico-philosophical as well as the historico-critical attitude is evidenced.

Even if one, for personal reasons, elects to ignore the tragically significant prophecies of Holy Writ regarding the continuance, indeed the veritable increase, of wars during the passing centuries, yet such an one may not blind himself to the fact that the pages of history reek with the records of warring nations; and that even our own fatherland, founded in the quest of liberty and peace, and which (as nations go) may fairly be accounted as a peaceful and a peace-loving nation—even we ourselves, as recently noted by General Pershing, have made at least one important demand upon our army for every year and a half of the past 150 years, and it has been called to participate in a major conflict every twenty years during the same period.

It requires not the vision of anointed eyes to discern in the world-wide unrest, in the flagrant international selfishness and jealousies, in the astoundingly successful cosmic promulgation of doctrines and practices and propaganda subversive of orderly and conservative government, in the countless matters of international friction and antagonism that yield most reluctantly to peaceful methods of adjudication—to discern in these and numerous other significant facts (that time and occasion

forbid orientation) a harvest ripe for the sickle, a mine ready for the spark, a pestilence of terror and destruction and death chafing at the artificial bonds that but temporarily hold in leash its world-wide progress. It is both illuminative and characteristic (but by no means flattering) that average American intelligence will shrug the shoulder in *laissez faire* contempt of investigating unpleasant problems that do not constitute an immediate and pressing and imperative menace; that we are willing placidly to continue the fatuous Anglo-Saxon policy of "muddling through"; and equally characteristically do we consider it an inalienable right, if not in truth a righteous appeal to high heaven, to raise violent protest against the avalanche of taxes that inevitably results from our stupid policy of juvenile procrastination.

In spite of the Geneva Convention, the Hague Peace Palace, the Peace Conference of Paris, the Treaty of Versailles, and the League of Nations, it may be confidently affirmed that the reign of war is not closed. Is it, in fact, such a difficult matter to discern that there is a vast, dark, swirling tide whose abysmal depths have never been fathomed, and whose turbulent surface is seen continuously lashed into a veritable hell's broth by the seductive but seditious utterances, and by the incendiary and destructive activities of individuals and organizations that are frankly and strongly arrayed against any and all orderly and sane government. It is wholly unreasonable to classify this analysis as militaristic in concept and fruition, for the recognition of the possibility, indeed the probability, of a catastrophe may not rightfully be construed as advocacy of a catastrophe. Such recognition is but the result of the thinking mind as contrasted with the autopersuasive babblings of the commonalty that antiphonally chant peace, peace, when there is no peace, the honeyed lispings of feministic pacifists, and the inflammatory mutterings of disruptive Socialist, I. W. W., Kehillah, Soviet and Bolshevik propagandists.

And yet further, to the forward thinking man, will be developed the thought that whereas in the past the United States has maintained a fairly consistent degree of non-participation in the unceasing brawls of the eastern hemisphere, yet our dominancy of the Panama Canal Zone, our possession of remote Pacifican islets, and our highly responsible (and in some measure regrettable) legacy from the Hispano-American War of West Indian and Philippine domains, and last but by no means least our active participation in the World War—these and many other ancillary factors will combine to focalize and accentuate the conviction that in any future conflict of the first magnitude the United States will find it exceedingly difficult, if not actually non-advisable, to maintain her former remote attitude of unruffled non-participation—an esoteric dweller in ivory towers.

It is not the purpose of this analysis to indulge in the fruitless gymnastics of casuistic prophecy concerning the incidence of the next great war. Suffice it for the present purpose to recognize that such a conflict is neither impossible nor improbable, nor yet of necessity notably distant; to recognize that in such a conflict the United States may well anticipate probable involvement (even though she herself may be neither the primary offender nor the primary defender); that for such a possible contest (and for possible contests of lesser magnitude) the Congress has authorized a somewhat comprehensive National Defense Act; that based upon this act have been developed far-reaching Reorganization Plans for the Army; that these plans include a Reserve Corps composed of commissioned officers, and that this Reserve Corps includes a Medical Reserve Corps.

The Medical Reserve Corps may not be commended to the medical man of civilian status on account of its pecuniary emoluments, for these are not enticing; nor yet on account of personal ease and comfort during the period of active warfare, for neither of these need be anticipated; nor yet, be it granted, does possible promotion yield adequate recompense for the sacrifice incident to service. But of special interest is the change for the better in the standing and authority conferred on the Medical Corps and Medical Department. It would seem beyond reasonable cavil that in the not remote past medical officers were granted a perfunctory, if not an actually insignificant, rank with negligible authority attached thereto; their counsel failed to bear full fruitage largely because it was not definitely sought and faithfully followed, neither was it supported by the weight of adequate rank or authority, and this in turn was the result of the absence of a well-defined national policy. Medical officers and Medical Department activity were tolerated for their useful functionation, but otherwise failed of adequate appreciation. It is a pleasure to be able to record that the Medical Corps and the Medical Department are gradually coming into their own; suitable rank has been granted supported by steady increase of authority, technical counsel is now sought and followed as never heretofore, functionation is being demanded in parallel with other branches of the service and there seems fair reason to anticipate a yet greater increase of personal and official appreciation and cooperation from other branches of the service as the imperative and vitally essential and far-reaching accomplishments of the Medical Department become more generally understood and, as a result, more thoroughly appreciated.

It is probably true that, during the relative quiescence of peace, it is more difficult to exemplify in the daily life the serene light of a lofty patriotism than during the furnace heat testing of stressful con-

flict. But to your patriotism appeal is made and to your clarified vision it is submitted that national preparedness in the day of safety against the coming day of danger is essentially and basically sound, both in abstract principle and in concrete practice; it is submitted that the Congress was wise in authorizing, and the War Department wa wise in developing, the Organized Reserves; it is submitted that a large measure of the enormous expenditure of time and money imperatively essential in emergency training will be avoided if there be developed and maintained a well-organized Reserve; it is submitted that we owe a substantial indebtedness to our late allies of the World War who grimly, and courageously, and doggedly maintained the *status quo* while we expended more than a year of invaluable time in mobilizing, organizing, training and equipping our forces; it is submitted that our own people were grievously burdened by needlessly huge economic and financial hardships; it is submitted that the major portion of distress to our allies and distress to our Fatherland would have been avoided if we had had in dependable activation a competent National Defense Policy and a properly organized Reserve; it is submitted that the fast multiplying complexities and the increasingly destructive and deadly outworkings of present and future warfare warrant the intensive consideration of every medical man; and finally, it is submitted that it is a personal privilege and a patriotic service that every qualified and eligible medical man file application for commission in the Medical Reserve Corps of the Army of the United States. The challenge is: that the high traditions of sacrifice and service historically exemplified by the medical profession must not be abated. The challenge is: meet your patriotic responsibility, meet it squarely, and meet it now.

THE TREATMENT OF HOOKWORM DISEASE BY CARBON TETRACHLORIDE[1]

By Major A. T. COOPER and Captain A. J. VADALA
Medical Corps, United States Army

IN A RECENT article in the *Journal of the American Medical Association*[2] there are reported the results of the treatment of hookworm by single doses of carbon tetrachloride, such a procedure, if efficacious, would be of great benefit at Fort Benning, Ga., in lessening the number of hospital days for the command.

All stools of patients admitted to the hospital are routinely examined for hookworm. Calculations previously made by one of the authors at the post of Fort McPherson, Ga., one year ago, seemed to indicate that 13 to 15 per cent of the adult population of this section of the country are infected with hookworm; this was also found to be true at the summer training camp at Camp McClellan, Ala.

The experience at Fort Benning has been that it takes, in the majority of instances, over two courses of thymol treatment to effectively cure a person of hookworm. While this treatment is in process the patient is hospitalized and the stools examined frequently until free of ova. The treatment, if indicated, by positive stools, is repeated in a week to ten days' time, not sooner, because toxic symptoms may develop. Manifestly it would be an advantage if it were possible in treating hookworm disease to have a vermifuge such that one or two doses would be sufficient, with no need for restricting the diet and hospitalization, not made necessary.

The reports available on the action of carbon tetrachloride seem to indicate that its action might at least be superior to that to thymol and that it might be the equal or possibly superior to oil of chenopodium.

With this in view, 125 c.c. of carbon tetrachloride was secured from the Station Hospital Clinical Laboratory, it being one of the reagents listed as laboratory supplies.

Carbon tetrachloride is a clear colorless fluid, having the formula CCl_4; specific gravity 1,629; molecular weight 153.8; non-volatile matter .001 per cent; B. P. 76°; free Cl., none; it has a rather penetrating disagreeable odor reminding one of chloroform and sulphureted hydrogen. Its taste is rather sharp and burning.

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[1] From the Medical Service, Station Hospital, Fort Benning, Georgia.

[2] Leach: "Carbon Tetrachloride in the Treatment of Hookworm Disease." Journal American Medical Association, June 10, 1922.

For the purpose of the administration of carbon tetrachloride, cases as a rule were selected for treatment who had not received previous treatment by other vermifuges.

In all cases showing presence of the ova in the stools, a second stool examination was made as a check for the first examination. To these, only one dose of 3 c.c. of the carbon tetrachloride was given. The drug was administered in soft gelatin capsules each containing 1 c.c. and was given in the mornings, preferably without breakfast. Later, as the effects of the drug on the patients were studied, we found that it did not matter, therapeutically or symptomatically, at what time of day the drug was given nor whether the patient had previously fasted.

Following the administration of the drug the patients experience very few symptoms (some none at all); the usual complaint is dizziness (this begins as a rule in a few minutes and lasts two to three hours), a sensation as if "drunk," a tingling and numbness in the extremities, a sensation of heat in the stomach, and drowsiness. The latter induces the patient to go to bed and "sleep it off," and when he awakes, all discomfort as a rule has disappeared and no further complaint is made.

To determine the day stools of patients become hookworm free, stool examinations were made every other day for ten days following the administration of the drug. Almost invariably the examination in all cases after forty-eight hours was negative for hookworm and has remained so ever since.

Further examinations were made every week for two months, these also have been negative.

For stool examinations, in order to obtain the largest possible number of positives, the fecal specimens are overlaid with a saturated aqueous solution of magnesium sulphate and a small amount of glycerin. This procedure brings the ova to the surface of the fluid in increased numbers which facilitate their transfer in large numbers (if present) to the slide by means of a platinum loop.

For the purpose of comparison in the efficacy of carbon tetrachloride as compared with thymol and oil of chenopodium, cases previously treated with either of the latter two drugs, and which now showed two consecutive positive examinations for hookworm ova, were given 3 c.c. of carbon tetrachloride. This treatment resulted in negative stools after forty-eight hours and have remained negative since the treatment (period, one month). One case that had been treated with thymol and oil of chenopodium, and which was still positive for hookworm ova, was given carbon tetrachloride with results similar to the other cases, i.e., cured.

For patients treated by thymol the average number of days spent

in hospital was 12.5. Many of these patients required two or more courses of thymol medication.

Oil of chenopodium has also been used in treatment of hookworm disease at this hospital. The average number of days spent in hospital for each patient receiving chenopodium treatment was 9. Many of these patients also required two or more courses of treatment. The above treatments were given one week to ten days apart because toxic symptoms, i.e., headache, nausea, vertigo and gastro-intestinal irritation would develop if repeated earlier. In giving thymol or chenopodium it was necessary to purge and restrict the diet of the patient.

Although the number of cases treated thus far is not large, yet the consistent negative stools following only one administration of the carbon tetrachloride, and the persistence in negative findings for those cases treated as long as two months ago by carbon tetrachloride, are sufficient to warrant faith in its use. In addition, there is the fact that patients need not undergo the previous discomfort of purgation and starvation. What is more important from the viewpoint of the army surgeon is the fact that these cases need not be hospitalized for treatment, and if hospitalized, then for no longer than forty-eight hours, in order to become hookworm free.

It is contemplated treating all cases of hookworm in this hospital with carbon tetrachloride. As far as we are able to determine at the present writing, the results obtained in this hospital with only one dose of the drug have been 100 per cent cure.

A PLEA FOR A CLOSER RELATIONSHIP BETWEEN PHARMACY AND MEDICINE[1]

By Commander R. C. HOLCOMB
Medical Corps, United States Navy

WHEN the Great War broke out, the United States came to a sudden realization that the manufacture of some important drugs then in use was entirely in the hands of German manufacturers. When the United States joined the Allies, the Alien Property Custodian came into possession of many of these patents, which were ultimately sold with the view to manufacture within the United States. The German monopoly in this drug manufacture was due to many reasons, but the most important were perhaps well-known economic reasons and the known skill and interest of the German people in the study of chemistry, the drugs in question being remedies of a chemical nature.

The sole power to prescribe drugs for the treatment of disease, is, or should be, in the hands of the medical profession. For this reason, if for no other, the medical profession should have a serious interest in all that relates to pharmacology.

When I first took up the study of medicine, some thirty years ago, it was not unusual for a professor in medicine to write and to recommend prescriptions containing six or more active drugs which, combined, often produced an unpalatable mixture. But there began to grow up about this time a school who regard these mixtures with disfavor, and owing to the extremes to which some of them seemed to go they weie called "Therapeutic-Nihilists." Their influence, however, was for good and was corrective. The investigations of Cohenhiem and his school had placed the pathology of disease on a more accurate basis. The discovery of a pathologic bacterium by Obermier in 1873 opened up a field of bacteriology; the triumphs of aseptic surgery took the treatment of what are now regarded as surgical diseases out of zone of drug treatment. These are only a few of the many advances that justified an entirely new conception of the treatment of diseases by drugs.

But the field of pharmacology is still large and has never been entirely in the hands of any one country, even though that country enjoyed certain advantages for the production of the raw material. We are still searching for the cause of many of the exanthems and a multitude of metabolic disturbances requiring skilled technical investigation.

[1]Read at the 30th Annual Meeting of The Association of Military Surgeons of the U. S., Washington, D. C., October 12-14, 1922.

We are in need of new and more potent remedies for the rheumatoid and other affections. Many of our useful drugs have found their way to us from humble sources; a West Indian negro skilled in treatment of fevers; the Corregidor of Loxa in Peru, recommending the use of a bark infusion to the Countess of Chinchon; the Straphanthus, used by African natives as an arrow poison; the fox-glove long used by European herbalists; the mercurius dulcis of sixteenth century medicine. But they have also come to us through the deliberate result of scientific research producing the alkaloid of strychnine in 1818, atropine in 1833, and the arsenical preparations of the present day.

Throughout our country, there are many laboratories now engaged in the investigation of diseases and these investigations have been so profitable that it is refreshing to learn that the oldest school of pharmacy in the United States, the Philadelphia School of Pharmacy, is proposing to provide a laboratory devoted to investigation and the cultural improvement of the grade of raw drug material already known. An adventure of this kind seems pregnant with new possibilities of national benefit.

In this work, when undertaken, they deserve the sympathy and cooperation of all medical men. They will need our assistance as we need theirs. An undertaking of this kind is wholly in keeping with the best traditions of the medical profession in that it will lift the production of new remedies out of the zone of a purely commercial undertaking as it largely exists today, to the unbiased criticism of scientific research.

Do we need a closer relationship to pharmacy? Yes, I think we do. One of the benefits that this closer relationship can serve is that of combating ignorance of the public at large in the false doctrines of cults and irregular medicine. Throughout this broad country in every state, in every county, in every township and village, is located the pharmacist to whom the public comes each year to spend millions of dollars for remedies. In the community he stands often a respected adviser in matters of simple ailment. He knows the ignorance of the general public on matters medical; he knows how due to this ignorance not so long ago the public was consuming gallons of patent medicine in blind faith that every printed word on the bottle was gospel truth. And it is this same kind ignorance that is leading people with more money than common sense to believe in and support a false doctrine of religious faith. It is a dense ignorance that has led others to a belief that appendicitis or fevers or rheumatic affections are due to the luxation of a spinal vertebrae which can be rubbed and manipulated back into position, with the relief of the symptoms and the cure of

disease. But we need this closer relationship for other and more altruistic reasons that our cooperation in public service for the relief of human suffering may be of the highest character, which is the best inspiration of public confidence. We need it, that the cultural properties of medicinal plants may be improved, that systematic search and investigation may reveal new remedies and improve the older remedies. As military surgeons we need this, that a day may not come again when we will find ourselves with an imperfect knowledge of the means for the preparation of drugs that occupy an important place in the treatment of disease such as we found ourselves at the outbreak of the Great War.

RESULTS AFTER ORBITAL AND OCULAR BATTLE INJURIES[1]

By RALPH A. FENTON, A.B., M.D., Portland, Oregon

Late Major, M. C., U. S. Army; Consultant in Ophthalmology, 3rd Army

(With eight illustrations)

THE splendid system of evacuation of the wounded from our battle fronts, grounded in military necessities, avoided at all times the congestion of hospital facilities in advanced areas, Rapid transportation of those casualties whose injuries did not preclude safe travel was insisted upon; among these frequently fell the ocular and orbito-maxillary cases, especially if unscathed in other parts of the body. Keeping of detailed case histories was very difficult, and the field medical cards which traveled with the patients were small, necessarily very brief, and not infrequently disfigured or illegible in parts after a hard journey on the person of a half-blind and disabled soldier. Coherent treatment, with an accurate dovetailing of the work of succeeding medical officers into that of the first to see the case, was thus made very difficult in these most trying cases; and it is a great tribute to the systematic work of Colonels Greenwood, Derby and Black that admirable results were the rule after the frequent transfers necessary to get a sick man to his final place of treatment in the United States.

The writer was assigned in 1918 to duty very near a busy American front during two important drives, with a rather large eye and facial service. The following brief reports, noted as the men passed through this hospital direct from their first dressing on the field, have lately been checked with official data on discharge, and by correspondence with the soldiers themselves. They are reported by letters in compliance with regulations governing publication of information upon which claims might be based; the original names are on file in the office of The Adjutant General, as a key to these results. Thanks are due to The Adjutant General of the Army and to Lieut. Col. J. W. Grissinger, M. C., late chief surgeon, 3rd Army, for invaluable assistance in the completion of this study. The slides are prepared after Lagrange.[2]

Case A had been ten days in field hospital (against orders) before he was sent down for operation; gutter wound of both frontals, orbital roof on left badly splintered, intersinuous partition loose in the wound, all bathed in thick staphylococcus pus. Lids drooping, no ocular involvement. Tension sutures, collodion tape, Dakin solution. Evacu-

[1]Read before the Pacific Coast Oto-Ophthalmological Society, Salt Lake City, September, 1922.
[2]Lagrange: Fractures de l'orbite. Paris, 1917.

ated in twenty days; healed in thirty; no disability; a deep adherent 5 inch scar across lower frontal region.

Case B had a machine-gun bullet penetrate the left cheek, taking out third upper molar, traverse hard palate without entering nose, opening roof of mouth on left side, crossing right antrum, and destroying part of right malar bone. Ecchymosis but no ocular damage. Suture of soft palate. Evacuated in three days. Two plastics of cheek and palate since; hole in roof of mouth into left antrum closed by prothesis; otherwise normal.

Case C received two pieces of high explosive shell; one entered the left orbit via the zygomatic fossa, destroying the eye and splitting the lids apart as it escaped; the other, 10 x 12 x 18 mm, entered over the left mastoid, traversed the temporal muscle and was lodged deep in the pterygoids, whence it was removed. Due to delay in sending this man down from the front, there was extensive infection of the orbit and zygomatic fossa, and gas bacillus infection was feared at first. After enucleation and Dakin solution, he was evacuated in seven days. After many vicissitudes, he became a patient of Major Wheeler of the New York Eye and Ear Infirmary, and is a notable example of the latter's plastic skill in three operations; he wears a glass eye without trouble.

Case D was hideously injured and is an example of the terrific vital force in some organisms. He was only a few feet away from an exploding projectile of enormous caliber. His right arm and scapula were blown off, and a huge fragment of steel tore away the right cheek-bone, antrum and eye, both ethmoids anteriorly, most of the septum, the ascending processes of both superior maxillae, the nasal bones, the cribriform plate, crista galli and much of the orbital plate of both frontal bones. The left eye was filled with blood; most of its orbital fat was gone, and the lids in part. It was possible to look directly over into his pharynx through the choanae. The wound was black and dry with clots and débris; an area of dura disclosing both hemispheres, perhaps 3 by 4 cm. in area, was visible pulsating above the orbits. This man lived; with plenty of morphine, and with a diet of eggs and milk, he became strong enough to be sent on seven days after he was wounded, 30 miles by ambulance. It may be said that a more careful driver could not have been found than the soldier who handled this case. The beginnings of staphylococcic infection in this vast wound yielded at once to Dakin pads kept constantly moist. He died in hospital in the United States eighteen months later, from a brain abscess affecting the left frontal lobe.

Case E was a puzzle case in a German boy; a young soldier of

seventeen from lower Austria, with a huge discolored wound of entrance just above the left zygoma, apparently entering the orbit behind the globe. Vision was good; there was some ecchymosis in the upper and lower lids. Search for the bullet in the nose and antrums was negative; there was no history of nosebleed. Hidden behind the left posterior pillar and the soft palate, however, was a broad gray exudate covering the wound of exit. After this was found, the patient remembered that he had expectorated a large hard object, with some thick clots, as he lay in No Man's Land during the first of the three days that he lay between the lines before he was picked up by an American advance party.

Case F, another example of extraordinary vitality, was brought into the hospital triage as a sitting patient, twenty-one hours after injury. The triage surgeon, seeing this man walk in, noticed one eye somewhat reddened and the lids bruised slightly, and sent him to a ward for the night without calling the writer away from other duty. Next morning the soldier was discovered on rounds in the ward, and on examination the right eye was found to be torn to picees, and a huge black shell fragment, the nose of a 177-mm. shell, was discovered subcutaneously just above the right ear. It had entered edge forward between the opened lids, and had torn out the roof of the orbit and the squama of the temporal bone, missing the middle meningeal by a very short distance, and was stopped by the temporal muscle and skin. This man remained conscious and even mentally alert until several hours after the foreign body was removed, when meningeal symptoms began. Owing to the enormous destruction of brain substance, coma and death were mercifully swift.

Case G, was also picked up in a ward a few hours after admission, with the complaint that he had lost his vision in the right eye. There was some ecchymosis about the inner canthus, and a ragged tear of the region of the caruncle. The fundus reflex was absent and the vitreous was apparently filled with bloody exudate. The anterior segment was almost normal. A "slight tear" of the lobule of the right ear was pointed out by the soldier. This was found to be the exit wound of a machine-gun bullet, which had entered the caruncle, scalped the lacrimal sac and the sclera, passed through the posterior angle of the antrum and internal to the ascending ramus of the jaw without injury to the ear or to the great vessels. A probe passed through this channel with ease, and Dakin solution was poured through it until his evacuation four days later. No pus appeared at any time. The sightless right eye was removed in the United States three months later, and the right tear sac eighteen months later. There has been no other dis-

turbance, although a temporary facial paresis from swelling arose during his trip home.

Case H was considered inoperable from shock and loss of blood at first, and for two days could not be moved from the mobile hospital which first received him. On arrival in our service, he was semi-comatose, with slow weak pulse. After treatment for his profound shock, operation was done eighty-four hours after his injury. It was found that as this officer turned his head toward the enemy, one machine-gun bullet entered below the inner canthus of the left eye, traversing ascending process of left maxillary, left and right middle turbinates, septum, right lacrimal sac, right eye, malar bone. A second bullet, an instant later from the same weapon, entered the inner canthus of the right eye, went through the eye again, and left the apex of the orbit, grooving the tip of the sphenoid, and opening the dura; thence out through the right temporal muscle above the posterior end of the zygoma. This large wound was found packed full of blackened clots and bone fragments. Brain substance was oozing down into the back of the orbit. The eyelids were torn extensively, especially at the outer canthus, and the skin over the malar bone, cheek and temple was ripped into jagged shreds. By careful piecing, and retention of all bone that had any periosteal attachment, the lids and cheek were rebuilt at once. A very large opening into the lateral aspect of the orbit remained. Convalescence and healing were rapid, except for annoying suppuration in the remnant of the lacrimal sac. He was evacuated thirty-seven days post-operative, with the temporal wound practically healed. Several plastic operations were done in the U. S. to restore the cul-de-sac for an artificial eye. While in our service in France, a prothesis made from an aluminum identification disk, cut down and hammered, and dipped in paraffin after Wilder's method, kept the conjunctival sac open; but this expedient was not practicable en route home. Colonel Blair finally restored the cheek contours and excised the scar tissue, and there is now some motion in the artificial eye.

Turning now to intraocular wounds, Case I had a foreign body 1 by 2 mm., entering via sclera above, with iris drawn up toward wound, evident cyclodialysis and hyplema obscuring the vitreous and lens. With the small Lancaster magnet (used in all such cases) the F. B. was removed from its location opposite the inferior rectus insertion by a small scleral incision below the lateral rectus. This man was evacuated next day. Some weeks later he had severe iridocyclitis after a long quiet period, and was advised to have an enucleation. Instead, he succeeded in rejoining his old command, the eye being temporarily quiet. His duties requiring much use of the eyes, irritation speedily resulted,

and he appeared at one of the eye centers in the Army of Occupation with well marked sympathetic irritation in the uninjured eye, and vision reduced to 20/40. Prompt enucleation (three months after the battle injury), with implantation of a glass sphere after Greenwood's method, saved the good eye, although it meant retirement from active service to this soldier. There has been no other difficulty since.

Case J had a shell fragment 3 by 5 mm. imbedded 20 mm. deep in the orbital fat, in the outer part of the right orbit. After magnet removal, and immediate evacuation, he shortly returned to duty, and at present has no disability.

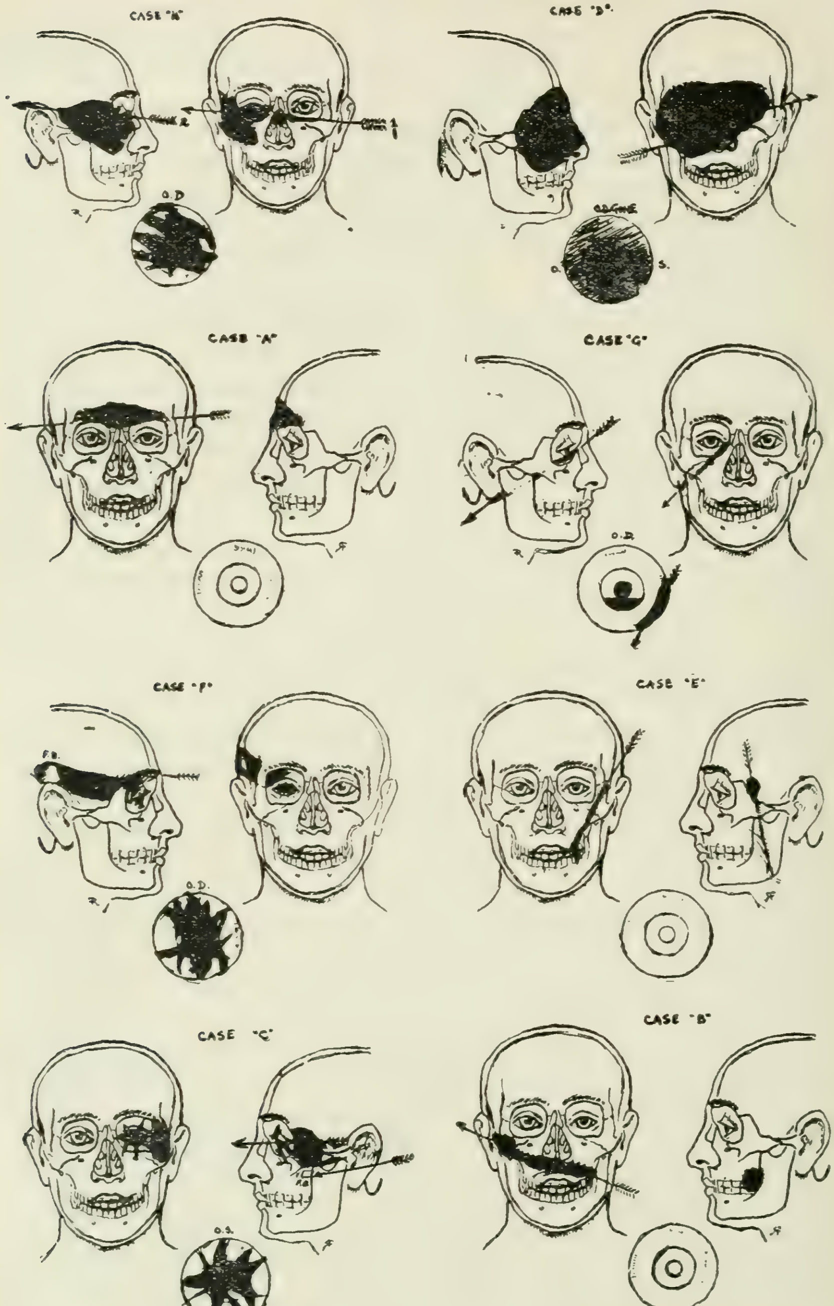
Case K entered with multiple small wounds; both eyes were penetrated by steel particles. The right, with hyphema and iridodialysis, had foreign bodies so small as to escape localization; vision, originally hand movements, is now 7/200 corrected to 20/50. The left, with a 1 by 1 mm. F. B. entering through a scleral cut, which came out readily to the magnet, had lost much vitreous and vision was almost gone. At present the left eye is blind.

Case L was interesting in that diagnosis of the location of the steel particle, which entered the sclera through the left upper eyelid, was readily made before X-ray localization, by the ophthalmoscope. Its track through the vitreous, about in axis 75, showed as a series of "bubbles," and the F. B. could be seen on the floor of the vitreous chamber below. Scleral incision between recti, and magnet removal, permitted evacuation in two days, and while vision on discharge was 20/70, the soldier states that retinal detachment has occurred, and that he has little or no vision in this eye now.

In Case M a triangular flap of about one-third the left cornea was turned downward under the closed lids; and on the lens lay a piece of a grenade detonator 2 by 4 by 1 mm. This was an accidental injury incurred "souvenir-hunting," after the armistice. In spite of a ribbon flap of conjunctiva thrown over this cornea, attached above and below, enucleation was done shortly after his evacuation.

Case N came in with a traumatic cataract from a shell fragment 2 by 3 mm. which traversed the pupil and came to rest behind the iris. After magnet removal, during which the lights were switched off for an air raid, making use of a flashlight essential for removal of the foreign body, which was clinging to the magnetized core of the Lancaster instrument, the patient was evacuated in two days. Later, in the United States, removal of lens substance was almost completely effected; there are some capsular remnants, which permit the fundus to be seen dimly. Vision is not helped by glasses in this eye; the left is normal.

Case O, last in this series, among other shell splinters, had one frag-


CASE "D"
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CASE "A"
CASE "G"
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CASE "E"
O.D.
CASE "C"
CASE "B"
O.S.

ment 1 by 2 mm. perforate the left cornea and iris, with considerable hyphema. In spite of easy magnet removal, after which he was evacuated in three days, the eye remained irritable and was removed not long after.

Extensive trauma by bone fragments and direct violence caused loss of eyes in the orbital cases wherever the eye was touched at all; but in the magnet cases it seems that the end results are far below those of civil life, in the proportion of eyes saved, or in the percentage of vision remaining. The terrific infection of French soil is a factor here. May we not also speculate upon the factors of danger involved in moving such cases, even though otherwise slightly or not at all disabled, over considerable distances, with unavoidable interruptions, delays, and changes of treatment? These considerations are not military; they are entirely surgical and medical. The half-blinded man is easy to manage if he is not moved about, but panic-stricken when forced to travel. With skilful nursing[3] such calamities as the wounded eye brimming with pus, crusted and wedged against a mass of dried cotton, are avoidable. Creation of ophthalmic hospitals very near the front, impossible for many entirely valid military reasons during the active operations of the Expeditionary Force, had long been planned by Colonel Greenwood and his staff. Longer hospitalization without premature changes would thus have been avoided; and it is hoped that this study will emphasize the value of such a step in the planning of future medical services for the zone of the advance.

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[3]It is a privilege to approve the devotion of Nurse M. Carter, A. N. R. C., who managed the special wards, surgery, and supplies for our ophthalmic and otolaryngological cases.

THE TREATMENT OF CHRONIC OTORRHEA

By JAY D. WHITHAM, M.D., New York

THE general practitioner is inclined to lightly regard a chronic discharge from the ear. The reasons for this inclination are, first, the slight inconvenience the discharge usually causes his patient, and second, his inability to check the discharge, which causes him to assume an indifferent attitude of mind toward the disease in general.

An otologist views the chronic discharging ear as a serious potential danger to life, and the disastrous effects of neglect and indifference are continually being brought to his attention. The following case is typical.

The writer was asked by a colleague in August, 1920, to see a boy, nine years of age, who had had a chronic discharge from his left ear since infancy. Examination of the ear showed a scanty muco-purulent discharge, with a small perforation in the postero-superior quadrant of the drum. The hearing was greatly reduced, but the labyrinth was active and apparently not impaired. The boy was healthy in every respect, except for the occurrence of an occasional transient attack of vertigo.

A radical mastoid was advised, but was not permitted. In August, 1922, two years later, the boy developed very suddenly, a septic sinus thrombo-phlebitis, which was ultimately fatal. A carefully performed radical mastoid operation would certainly have prevented the tragic outcome.

The chronic discharging ear can truly be considered a greater menace to life than the acute discharging ear. Acute conditions are constantly watched, the early danger signs are usually obvious, the treatment is generally carried out more thoroughly and consistently, the condition is better understood by the general practitioner, and operative treatment is nearly always afforded the patient before the onset of serious complications. The chronic ear, pursuing a painless course, usually causes slight concern to either the patient or the physician; the advance of the pathological process occurs without symptoms, and when symptoms do enter the picture their significance is not appreciated in many cases.

The presence of a chronic otorrhea usually signifies that the otitis was inadequately treated during the acute stage, when an early paracentesis and careful syringing every two hours would have sufficed. A simple mastoid operation performed during the active stage is certainly preferable to condemning one's patient to years of otitic dis-

charge, permanent impairment of hearing and a potential menace to life.

The keystone of success in treating chronic suppurative otitis media is cleanliness. When the discharge is profuse, irrigation with normal saline or boric acid solution may be needed, but, generally speaking, irrigations are to be avoided in chronic otorrhea. The use of water is frequently irritating and often increases the discharge. In such cases, the installation into the ear of peroxide of hydrogen, followed by careful cleansing with the cotton-tipped applicator and the use of ten drops of bichloride in alcohol solution, is one of the most useful procedures. The peroxide and the bichloride drops should be each allowed to remain in the ear for about ten minutes. Prior to any form of treatment, the ears should be carefully examined, and excessive granulation tissue removed by a small ring ear curet or by application of silver nitrate. The margins of a perforation may be touched at frequent intervals with a silver nitrate or trichloracetic acid after the discharge is controlled.

In addition to frequent treatments by the physician, the patient should be instructed to instill in the ear the alcohol and bichloride drops. This should be done three times a day. Tuberculosis and syphilis should be ruled out or appropriately treated if found to be present, as they are sometimes the cause of chronic ear suppuration. The medical attendant should gently inflate the middle ear once or twice a week, using the Pollitzer bag or Eustachian catheter, as this procedure not only aids in the mechanical cleansing of the ear cavity but also prevents adhesive processes in the middle ear. Aurists have advocated the use of many antiseptics such as iodine, phenol and acriflavine, but the drug selected is of less importance than the painstaking care taken by physician and patient to insure the rapid and complete removal of the discharge. The large majority of cases will clear up under the treatment outlined. When, however, a case is found which resists all forms of treatment for a period of several months, the radical mastoid operation should be considered advisable. When performed by an operator familiar with the delicate anatomy of the temporal bone, on cases in which the operation is truly indicated, the results are indeed most gratifying.

The simple mastoid operation is an operation which is performed to relieve an acute inflammation of the middle ear and mastoid cells. A radical mastoid operation is one which aims to cure a chronic middle ear suppuration. As a rule, much less bone is removed in performing the latter than is the case with the former. The simple mastoid operation removes the mastoid cortex, all underlying diseased cells, and establishes thorough drainage of the mastoid antrum. The radical

operation consists of a conversion of the middle ear antrum and all diseased spaces within the mastoid, into a single cavity, which is drained through the external auditory meatus, and which is ultimately lined by skin continuous with that of the auditory canal.

The decision as to when a radical operation should be performed is a difficult one to make. From a pathological standpoint, it is indicated when the mastoid structures, antrum and intratympanic structures are all involved in the disease. The presence of foul-smelling pus with granulations, which condition fails to be remedied by local treatment, furnishes the usual indication.

When the chronic discharging ear is associated with cholesteatoma, facial paralysis or symptoms of intracranial complications, the radical operation should be immediately performed. To detect most of these conditions requires undoubted skill and experience.

The radical mastoid operation will stop the discharge and in some cases improve the hearing. It removes the potential danger of brain abscess, meningitis, septic sinus phlebitis, labrynthitis and facial paralysis, thus greatly increasing the expectation of life.

AN OLD REPORT

By Colonel RICHARD SLEE, M.O.R.C., U. S. Army
Swiftwater, Pa., Formerly Commanding Camp Crane, Allentown, Pa.

EXPLANATORY

THE brief notes following were dictated in December, 1917, on the request of a medical journal, but, owing to stress of work, were not submitted for publication. They are interesting principally as fact records compiled at that time.

Subsequent events proved that, on the whole, Camp Crane continued its enviable health record. During the great influenza epidemic in the autumn of 1918, the camp was completely surrounded by communities in which the death rate from influenza and subsequent pneumonia was appalling. By the introduction of simple sanitary measures *before* the scourge reached the vicinity of Allentown, we passed through the epidemic with only 355 cases of influenza in a crowded camp population of above 10,000. The rate as a whole for the Army was 252 cases per thousand. We had but 62 following cases of pneumonia and only 13 deaths.

The venereal rate for the entire history of the camp was lower than that of any other camp in the United States or Europe. Some camps had as high as 275 cases per thousand. In approximately 20,000 men during two years, there were 414 cases discovered—only 160 of these contracted after entering the service.

I think that the Medical Department may well take pride in the results achieved during the two years approximately in which Camp Crane was in operation—commanded and conducted in all branches except the Q. M. by Medical Department officers and men.

REPORT PREPARED DECEMBER, 1917

In view of the disquieting reports concerning the health of troops under training at various cantonments, the public at large, and also the friends and relatives of the commissioned and enlisted personnel of the United States Army Ambulance Service, located at the Concentration Camp, Allentown, Pa., will be interested in learning what has been accomplished at this cantonment.

The Ambulance Service Camp at Allentown has been in operation seven months. It was established and has been operated during this time entirely by medical officers, no line officers whatever being associated with the camp or its activities except the Camp Quartermaster's Department.

Approximately 7,000 men have passed through the camp, and its permanent inhabitants have averaged 4,500.

Its morbidity history may be briefly summarized as follows:

There has not been a single death from disease in the entire command since its organization. Only one death has occurred in camp, following operation for a ruptured gangrenous appendix, and one other member asphixiated while on leave. There has not been a single case of infectious disease of any character, with the exception of 19 cases of mumps (discovered while on train to camp), although the camp is located in a city, in which measles, scarlet fever, diphtheria and mumps have been present.

The venereal rate at all times has been very low and constantly decreasing, for the month of November only 12 cases of gonorrhea being reported or discovered, the total cases for seven months for an average of 4,500 men not equaling the monthly rate per 1,000, as reported from National Guard and draft camps.

Pneumonía, so virulent and fatal in other camps, total 9 cases during the same period, are convalescent or discharged cured (no deaths).

One case of meningitis (of tubercular origin) recovering.

Of the 12 cases of syphilis, 9 cases were active on reporting to camp after enlistment.

The question will naturally be asked why any one camp should show such an unusual and unprecedentedly low morbidity and mortality rate, and it must be confessed it is a hard question to answer, as a number of factors must be considered.

From my point of view I will state the reasons:

1. This has been strictly a medical camp from its very inception, the location and practically all details pertaining to its working having been directed by Col. Elbert E. Persons, M. C., U. S. Army, its commanding officer.

2. Until quite recently every commissioned officer was a medical man, all, with the exception of five, being Reserve Corps Officers.

3. The enlisted personnel is and has been of an unusually high type, recruited largely from colleges and universities, some 49 institutions being represented by one or more full sections of 45 men.

To the character and manhood of our enlisted personnel do I give the credit for our present enviable position in comparison with the other camps, not one of which can even approach us in health records.

These men are largely red blooded, well trained and obedient athletes, they have learned how to obey, and it required but little effort to impress upon them the necessity for strict sanitary regulations.

While their birthplaces cover the entire map of the U. S. A., they have evidently all been enough exposed to the various diseases of childhood to have acquired an immunity sufficient to protect the major portion; otherwise, with exposure in the city of Allentown, which has been at all times unrestricted to the holders of honor passes, we would have had a higher percentage of infectious diseases.

Critics may say, "Well, the camp is unusually well located," the men are and have been well housed, and this accounts for the exceptional results obtained. As one of the first officers in camp, I can dispute some of these assumptions.

The Fair Grounds in Allentown cover some 50 acres with the usual buildings, and an unusually good grandstand seating about 25,000 people. Under this grandstand can be seated at one time 2,500 men at mess, and I believe this grandstand with its opportunity as a mess hall and the various buildings as shelters were largely the deciding factors that persuaded Colonel Persons to select this camp.

Our colonel's selection was, as the boys say, all O. K. for the original number intended—about 2,500 men—but before we were well under way our Ambulance Service was increased to 4,500 men and then to 7,500, and the men piled in upon us almost without warning and we had to take care of them, house and feed them whether we were ready or not.

Few complaints were heard, although many had an uncomfortable time; buildings could not cover them, so tent flies and pup tents came into play and were used till Q. M. barracks could be built; and during the greatest press some 2,000 men were camped about 5 miles away, where they "dug in" in the most approved fashion. Other contingents were continually on the march, camping out and becoming hardened in a degree for the work before them over there. Clothing, blankets, shoes, etc., did not "come along" as expected, but with the telegraph and telephone at hand the C. O. early corrected the shortcomings.

Soldiering is no easy task nor a lazy man's job, and our men have had a taste of what they may expect "over there" and what several thousands of the Ambulance Corps are already experiencing after having passed through the Allentown camp. In fact, from letters we judge that, with all its trials, hardships and shortcomings, the camp at Allentown looks somewhat as the Broad White Way does compared to a country lane to our boys trained here and now somewhere in France.

Allentown is unfortunately without a sewer system (now remedied, 1922), and the camp had to depend almost entirely upon earth latrines for the disposal of all excrement. It required eternal vigilance and work on the part of the Sanitary Corps, but—flies were almost unknown in or about these shelters, and there was little soiling of the grounds.

The mess has been bountiful—well prepared and wholesome, not a single case of illness has been traceable to the mess—and the government ration has permitted a saving of thousands of dollars, returned to the section mess funds.

The mess officer of this camp also instituted the system of separating and selling the table refuse and garbage, with the result that hundreds of dollars have been added to the mess funds.

Altogether, the U. S. Ambulance Service Camp at Allentown, Pa., has been a mighty interesting and instructive place to be stationed, and it proves conclusively that the Medical Department of the U. S. Army possesses brains the equal at least of any other corps or branch, and it challenges any other camp to show a record of seven months, under the same conditions and difficulties, that is within measurable distance.

QUO VADIS? [1]

By Colonel GUSTAVUS M. BLECH
Medical Reserve Corps, United States Army

FOUR years have elapsed since at the eleventh hour of the eleventh day of the eleventh month of the year following our entry into the World War, the gigantic conflict, which for over four years had shaken the peoples of our globe to an extent unknown in the annals of this planet, came to a tactical end.

Soon after a glorious army of 4,000,000 Americans, organized in armies, army corps, divisions, brigades and regiments of a size which would have been declared incredible but a few years ago, deposited its standards for safekeeping, sheathed its swords and dispersed in all directions to return to its penates.

Four years! How many of our own comrades have been stricken from the rolls! As we look through the pages of the *Journal of the American Medical Association* week after week, we note that our old ranks are thinning every day, thinning through the departure of men who have creditably worn the uniform of a medical officer of the Army of the United States, for that land of eternity, from which there is no return.

And one cannot help but sadly reflect what another decennium will bring forth. How many more will have left us forever, how many will have passed the age of military activity, and how many will be incapacitated through other causes.

Quo Vadis? Sooner or later every one of us will be "dropped from the rolls," and it is time, therefore, to pause for a moment in our maddening race for temporary fame and wealth for purpose of orientation.

Four years have elapsed since the armistice between the Central and allied armies has been effective. I purposely refer to a lasting armistice, for in some sections of the continent the war continues, as an offshoot of the one of which we are veterans.

Four years should suffice to allow the usual post-bellum reaction to wear itself out. We should now be in possession of our mental equilibrium, enabled to view things of real importance in a judicial spirit, free from animus and prejudices.

Even the political, economic, racial and religious waves that have swept over our land had to disappear in the sand, broken by the force of stern sanity, which demands unconditional surrender to the law of our land.

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[1] **President's address delivered at the Second Annual Meeting of the Association of Military Surgeons of Illinois, at Chicago, November 20, 1922.**

It behooves us, as representatives of a profession with ideals, to reflect on our duties and obligations, not only to those who today demand our services as healers but to the entire nation, which still considers us potential defenders of its sovereignty.

Other professions and military specialists have already forgotten all about the great war and have in all earnestness begun work so as not to be caught napping, should opportunity arise again. I mention only that the infantry, the engineers, the quartermasters have organized themselves together for the pursuit of study and for the purpose of raising their standards of efficiency.

Shall it be said that the medical men, the very men who have always looked upon humanitarian service and self-sacrifices as *conditiones sine qua non* of their very existence, will be found wanting, should the bugle be ordered to sound the call to arms and should the regimental standards be again unfurled as a marker for the spot where to report with a cheery "here"?

The profession of arms is, indeed, an anomalous one. Every artisan, every artist, every scientist who has devoted a number of years of his life in preparation, is entitled to a career and has the opportunity to pursue the career for which fitted. The soldier, on the other hand, just as the scientist, pursues elementary and advanced training, and when he has reached a period when he knows he can give a good account of himself, the very state which made his education possible is exerting every effort to keep him inactive.

But no human mind is great enough to forsee when circumstances may compel the soldier to function, and function with every ounce of energy and every cell of gray matter at his disposal, and it is this very uncertainty which serves to the nation's defender as a stimulus properly to utilize the free hours to pass the great test with success.

What are these circumstances? What possibility is there for another conflict within the span of life?

We scan the pages of history, European, Asiatic and our own, we study the political horizon, east, west and south, and we can only say: nescio.

But this much we do know—that human nature has never been changed by philosophic writings, by religious incantations or by sealed international treaties, and that sooner or later, perhaps when least anticipated, the veneer of civilization will be broken like a weak shell, and again we shall have to transform the ploughshare into a sword.

But, say you, why all this lamentation? Ours, unlike that of the soldier, is a positivistic profession. Day in and day out we keep abreast of the times and our diagnostic acumen and therapeutic skill fully de-

veloped, so that, in the event of a national calamity we have but to close our offices, replenish the old field trunk with some essentials and we are ready for work.

But right here is where we come to a dilemma, not so easily brushed aside. Because we look after our sick and do so daily, we conclude that we are ready to take our old places in our army and navy.

Let us see. It is too bad that language has dubbed the man who has participated in a war with the title veteran. That word implies ageing and experience. How many of us can boast that we know something of war, simply because we have served in a hospital even at the very front? Very few, I fear.

There has always been a conception that physicians and surgeons joining the military forces remain just what they were—physicians and surgeons.

That we really became medical officers, military officers, soldiers, at least as much so as those of other technical corps, does not enter the minds of the profession, and certainly not of the laity. Nevertheless it is a fact that we must never ignore, that our duty in war is primarily to do our share towards terminating the conflict in our favor, and secondarily only toward the alleviation of the individual sick and wounded.

Do not be misled by the designation "non-combatant." If shooting were the only function of warfare, the strategic and tactical problems involved would, indeed, be most primitive.

Warfare, however, is a complicated affair, a difficult science that cannot be acquired even in an intensive three-month camp course and—we may as well be frank—even the experience of those volunteer officers, line and staff, who have had the good fortune to serve overseas has been so limited that the title "veteran" is, in a certain sense, a misnomer.

Permit me to divert for a moment to glance back as far as 1917. Had we been forced into the war without the Belgian, French and English allies holding the lines until we could get our nation into a semblance of military shape, we would have been annihilated, and instead of complaining that the dollar does not go as far as it used to, we would be in a worse economic situation than Austria, because our conquerors would have resorted to no dilly-dallying methods to drain our resources to the utmost.

Our little Regular Army and our partly trained National Guard, equipped only with rifles and small-caliber field pieces, could not even have lasted as a buffer until our citizens could have been uniformed and taught which end of the rifle to point in the direction of the enemy.

Even as it was, with nearly a year of grace, we had to perform mir-

acles, and as for our military efficiency, it is best not to scrutinize it too closely. But we won the war. That is the hue and cry raised by our pacifists today.

Let me answer that in my own way. There are two ways of swimming—one against the current and the other with the current. The man who chooses to hold incense under the public nostril is like the man swimming with the current—he has it easy, but he is drifting perhaps in the wrong direction. I choose to be blunt, to tell the truth as I see it, because my goal lies in the direction away from the popular current, and I say that, during the World War, many of our volunteer officers were neither prepared nor qualified for leadership.

If you think this statement to be the words of a pessimist, I will conjure up to your minds the name of a little French city—Blois.

Blois was the salvage depot of officer material, condemned at the front as unserviceable. In Blois these misfits were sifted through in the hope that some could still be utilized for less responsible work in the rear zones.

Blois' human salvage depot was a busy place until the defeat of the Central Powers was a *fait accompli.*

Even the most sanguine of our real leaders will tell you that many of our boys now slumbering in French soil would have been returned to their homes had our officers known their business!

We have won the war. But how? What, after all, of the fact that we went into lines already held by our allies? Supposing that had not been the case, as may be in the future; supposing we had had to confront the trained and specialized shock troops of the eastern front, what defeats would there have been in store for us until we could have organized for the supreme moment.

And maybe, if that had been the case, hundreds of our officers would not now find themselves confronted with the threat of poverty, out of a job they had sought and gotten in good faith.

The pacifists are jubilant. They do not care how many post-offices are being built in Squeedunks, and they are quick to tell you that such expenditures feed the suddenly beloved unskilled laborer, as long as the officers of the Regular Army are being "degraded" or thrown out, the enlisted strength reduced to a constabulary size, the National Guard permitted to maintain club meetings, and the reservists to frame their commissions.

But who are these pacifists? Are they traitors to our country in the pay of designing enemies, for the purpose of weakening the only organization that assures the continuation of our national existence in the face of international greed and envy? Oh no, no; they are far more

dangerous than that. They are well-meaning American citizens, whose fanatical creed is that armies and ordnance factories invite war.

We can sympathize with them, for we know what a diagnosis we would make if one were to promulgate the doctrine that surgeons invite laparotomies and that biological laboratories are the direct cause of epidemics.

Those of us, however, who are sane enough to realize that we have not yet reached the millenium must also be convinced that the World War, as far as we are concerned, has not afforded us the opportunity to become familiar with even the most elementary tactical problems which we are likely to be called upon to solve in the next war.

While this is of no particular importance to those who are destined to labor in the general hospitals in strictly professional capacities, the majority of our colleagues will be assigned to duty with regiments and frontal sanitary formations, units which will be compelled to maneuver with armies on the offensive.

During the World War we saw fighting from trenches, so that the tactical problems amounted to those of a so-called position war. Formulae had been prepared for us; we had the ingredients; and as for the mixture, that was merely a matter of expenditure of time and energy. There was nothing complicated about this process, and yet we made errors.

But in our next war the situation will be different. To illustrate this I need only point out that at Fort Leavenworth, that great school of military leadership, the student officers are given problems which must be solved in the rugged hills west of the Missouri River. In all of these the principal characteristic appears to be the location of the enemy and the getting at him. One sees nothing of dugouts 20 feet deep, where medical officers can finish a game of cards until the cessation of the artillery barrages calls them to work.

And just as the combatant comrades are going out into the open, moving hither and thither as the exigencies of battle dictate, they will want to know that their medical comrades are close by, ready to give them moral and physical support.

Are we really prepared to do this? Can we interpret battle orders and estimate battle situations? Can we properly coordinate our activities to be as effective in a rapid advance as in a hasty retreat? Can we read topographic maps so as to select the best possible terrain for our purposes? Do we know what supplies are essential for our aid, dressing, collecting, assortment and hospital stations?

If we know the great machine we are to serve, and if we know how to serve it well under all conditions of modern warfare, then we have a right to rest on our laurels.

But if we do not, then it is our duty to remain in contact with those who are charged with the task of looking after military preparedness, to give up a small part of our time for the purpose of perfecting ourselves for a possible summons.

But even if a call should not come during our lifetime, we shall have built up a great reserve corps, a scientific association such as is our national body, of which this is a state branch, both of which should exist forever as protection and inspiration to those who will inherit us. And we can leave them no better words of counsel than a device which should be inscribed in our hearts as well as on our coat of arms:

"OMNIA PRO PATRIAE CARITATE!"

COMMENT AND CRITICISM

THE SEVENTY-FOURTH ANNUAL CONVENTION OF THE A. M. A.

The American Medical Association will hold its seventy-fourth Annual Convention at San Francisco, June 25 to June 29, 1923. Several other National Medical Organizations will hold their meetings the week before, during, and the week after the American Medical Association. These include the American Society of Tropical Medicine, the Radiological Society of America, the American Radium Society and the California Medical Association.

The California Headquarters, under the chairmanship of Dr. W. E. Musgrave, have been opened at 806–809 Balboa Building, San Francisco. The Central Committee is very anxious to have as many physicians attend this convention as possible. Particularly do we want the officers of the Medical Department of the United States Army to come and take part in the meeting.

The summer railroad rates to California from all parts east are more reasonable than they have been for many years. Hotel prices will not be increased for the Convention and a large list of hotels and their exact prices will be published in an early number of the Journal of the American Medical Association. The California Headquarters' Offices will be glad to answer any questions or to render any possible assistance to any person contemplating attending the convention. Through our various contacts we are prepared to furnish information on any subject relating to California, and will be glad to assist in arranging vacations of from one day up for one person or any group of persons. You are invited to make your plans to come to the convention and communicate with the San Francisco office for any information of whatever character.

RESERVE OFFICERS COMMENCE IMPORTANT STUDY ON REVISION OF REGULATIONS

The Committee for the Revision of Army Regulations pertaining to the Officers Reserve Corps had its first meeting January 10.

It was welcomed by Brig. Gen. C. H. Martin, Chief of the Personnel Division, General Staff.

Brig. Gen. John McA. Palmer, Aide-de-Camp to General Pershing, addressed the committee.

The chairman, Col. William R. Smedberg, Jr., G. S., spoke regarding details of the work to be covered.

There were present reserve officers representing each of the nine corps areas.

The following reserve officers are on the committee: Lieut. Col. G. G. Reiniger, G. S., Asheville, N. C., 4th Corps Area; Lieut. Col. H. P. Ward, G. S., Hamilton, Ohio, 5th Corps Area; Major Fred B. Ryons, G. S., Lincoln, Nebr., 7th Corps Area; Major John Perkins, G. S., Alpine, Texas, 8th Corps Area; Capt. John B. Seymour, G. S., Chicago, Ill., 6th Corps Area.

BOOK REVIEWS

A TEXTBOOK OF HUMAN PHYSIOLOGY, including a section on Physiologic Apparatus, by Albert P. Brubaker, A.M., M.D., LL.D., Professor of Physiology and Medical Jurisprudence in the Jefferson Medical College, Philadelphia, Pa. Seventh edition. Philadelphia: P. Blakiston's Sons & Co.

This book, as stated by the author, is primarily intended as a textbook for medical students. It is written by a man who has had many years' experience as a teacher and who presents his subject in a clear and concise manner.

This edition follows the same general arrangement as the previous one, the subject-matter being considered under the same general headings and in the same order. Although some of the material in the sixth edition has been omitted as being obsolete, additional matter has been added so that the text has been increased by forty pages.

Important new material has been added concerning vitamines, basal metabolism, blood chemistry, urinary secretion, acidosis, changes in the consideration of nerve mechanism, etc.

A number of new cuts and diagrams have been added. One of these by Bachmann is a diagram showing the location of the intracardiac groups of postganglionic cells and the distribution of their fibers to the sinoauricular and auriculo-ventricular nodes; also the relation and termination of the preganglionic fibers of the right and left vagus to the intracardiac cells.

An appendix of 26 pages follows the general subject-matter. Here the various items of physiologic apparatus used in the laboratory are described. For the most part these items are ones in general use, the first description being of the electric cell. Leads, electrodes and induction coils are next described. Throughout the text proper numerous cuts and descriptions of apparatus used in special procedures appear. The description of these various articles is so clearly and simply stated that the student should have no trouble in understanding their mechanism and application.

GEORGE F. LULL,
Major, Medical Corps.

DE ARTE PHISICALI ET DE CIRURGIA OF MASTER JOHN ARDERNE, SURGEON OF NEWARK, DATED 1412. Translated by Sir D'Arcy Power, K. B. E., M. B. Oxon., F. R. C. S., from a transcript made by Eric Millar, M. A. Oxon. With colored frontispiece and 13 plates. New York: William Wood & Company. Price, $4.00.

Among his other foundations for the advancement of the arts and sciences stands the Wellcome Historical Medical Museum which was established by Mr. Henry S. Wellcome in 1913. One object, among others of this institution, is to publish from time to time accounts of the research work carried out on the manuscripts and documents of special interest and importance to the museum.

The World War starting so soon after the foundation of the Museum interrupted this purpose and it is only lately that there has been issued by Mr. Wellcome the translation of John Arderne's work. Together with the translation are halftone reproductions of photographs of Arderne's manuscript as preserved in the Royal Library at Stockholm. This manuscript, although its existence has been known for some time, has not excited much interest and has not heretofore been transcribed in full or printed. In 1909, Mr. C. J. S. Thompson, M. B. E., Curator of the Wellcome Historical Medical Museum, obtained such excellent photographs of it that is has been possible to transcribe nearly the whole of it. A replica, the exact size of the original, is now in the museum in London.

The original is written on twelve skins of vellum which are sewn together to make a scroll 17 feet 8 inches long by 15 inches wide. The writing is in three columns and is abundantly illustrated by colored pictures, all being quaint, some artistic and many showing a sense of humor. The writing, Mr. Power states probably to be of the early fifteenth century, which agrees with the date of 1412 added to the text by a later hand. John Arderne was born in 1307 and lived nearly to the end of the fourteenth century. He practiced in Newark until 1370, when he came to London, and was probably admitted a member of the fraternity of surgeons. He was essentially an operating surgeon, and his practice was among the nobility, wealthy landowners and the higher clergy. He was well educated though a layman, and he met his patients on terms of equality. He was a sound practical surgeon who carried out his work by methods which are not very different from those of the moderu aseptic surgeon. He taught that wounds should heal without suppuration, that local applications to them should be as little irritating as possible, and that the dressings should be infrequent. His medical treatment was essentially that of the Saxon physicians, and he believed in treatment by spells, herbs and nasty or innocuous substances. He was also somewhat of a pharmacist, and his name lived longer in this respect than as a surgeon.

Arderne issued his writings in the form of separate treatises, one of which appeared in 1376 and another in 1377. His treatises were afterwards collected by different persons and translated at various times in the fifteenth century. A number of his manuscripts show that his teaching had a considerable influence on English surgeons for many years after his death. It is remarkable that none of his work was printed until 1588, when John Read of Gloucester published an abridgement of the "Treatises on Fistula."

The edition issued by the Wellcome Historical Medical Museum is a quarto, is well printed, and the reproductions of the original manuscript which appear as plates throughout the text are so clearly done that it would be an easy matter for anyone conversant with the language to translate them. It is a book which is well worth while to anyone who has an interest in historical medicine and should be a valuable addition to the library of those who have this particular bent.

Brain Abscess—Its Surgical Pathology and Operative Technique, by Wells P. Eagleton, M. D., Newark, N. J.; President American Otological Society, 1921. New York: The Macmillan Company.

The book is original in conception. It aims to make the examiner think in terms of pathology and to plan his operative procedure, so that it may be adapted to the exact pathological condition present, and at the same time to utilize surgically the active protective forces of the brain.

Its classification is based upon the mode of entry into the drain of the different pathological processes causing brain abscess; for which the terms Adjacent (secondary) and Intercurrent (tertiary) are suggested. By utilizing this classification the surgeon is assisted in determining not only the existence of an abscess, but also its position and the presence or absence of a capsule.

The text is divided into a description of the microscopical lesions of brain abscess, followed by the physiological and mechanical conditions which must be dealt with surgically, and concludes with a description of the technique best adapted to meet them. The technique is in small type.

The scheme of the book allows the reader to peruse a general treatise on the pathology and surgery of brain abscess without the tiresome details of operative technique, and yet supplies the latter in the proper place, so that the proper technical procedure is readily and systematically available.

The book is primarily a record of personal experience; but, as there are over 700

references from recent literature; a compilation and analysis of the 125 post-mortem records of cerebellar abscess which had been reported up to 1919; 141 recorded cases of frontal lobe abscess; in addition to 31 personal cases reports, with the diagnostic and surgical lessons learned from each, it may claim to be an encyclopedia of the surgical pathology and operative treatment of brain abscess.

The illustrations (with two exceptions) are from the original drawings and photographs.

The author has been six years preparing this book; the basis having been written while he was in the service of the United States Army.

Part I (Chapter I and II) applies to Intradural Technique in general and aims to be of assistance to any surgeon who attempts an intradural operation. It correlates the recognized devices of intradural surgery.

In Part II, Chapters III and IV deal with the Pathology of brain abscess and the Surgical Classification; call attention to the importance, from a surgical standpoint, of the presence of a capsule, and how it should be diagnosed and utilized; emphasize the mechanical factors present in brain abscess; and furnish the minute technical details best adapted to overcome them at operation, including a description of an original flap for the exposure of the middle fossa low down through a clean field.

They also lay stress on the value of the protective processes of the brain and the importance of conserving them.

In Chapter V the author gives his views on Metastatic Abscess, which are somewhat original; as he regards metastatic abscess as frequently of aural or nasal origin. This he attempts to substantiate by personal cases and by a compilation of all the cases reported in the literature in which the abscess was in the hemisphere opposite to the primary aural or nasal suppuration.

Chapter VII (Sections 1, 2 and 3) is an attempt to place Cerebellar Abscess on a sound surgical basis.

It aims to assist the surgeon in localizing the situation of the abscess from a study of the mode of entry. It is based on personal experience and an analysis of all the post-mortem records of cerebellar abscess in the literature (about 125), a review of which is given in the appendix.

The surgical division of the posterior fossa is original. The occlusion of the lateral sinus by invulsion of its outer wall into the cavity of the sinus, is also original and, it is hoped, will prove to be a distinct advance in surgical treatment, as it allows a free exposure for inspection and exploration of the cerebellum through a clean field.

Chapter VII on Frontal Lobe Abscess is largely the result of a study and analysis of all the cases reported in the literature. This analysis revealed that surgeon after surgeon had made the same fatal mistake of draining the frontal sinus without an intradural exploration; thus forfeiting an opportunity for a successful operative intervention; as a large proportion of adjacent frontal lobe abscess cases die suddenly.

It emphasizes the importance of the protective character of the nasal and accessory sinus membrane and the danger of traumatizing them.

Chapter IX on the Protective Mechanism of the brain explains the action of the delicate processes within the dura which must be preserved and encouraged if a case of brain abscess is to recover following an operation. It is based on the experimental work of Flexner, Weed, Machlin and Bull, and is the first attempt to correlate this experimental work and make it applicable to brain surgery.

In Part III, Chapters X, XI and XII, the Diagnosis of Brain Abscess is very exhaustively treated in a rather unique way and aims to assist the surgeon toward a diagnosis of abscess at an early stage by adopting a definite mental policy. They explain the symptoms of brain abscess on the basis of nervous physiology by giving the anatomical and physiological reasons for the different symptoms. They emphasize the diagnostic

value of "little things." They contain original features, such as the value of "the initial chill" in the diagnosis of a capsule, diagnostic value of "disproportion," of "pathological sequences," and the possible causes of the subnormal temperature. The presence or absence of papilloedema and the value of "transient symptoms," such as an aphasia, and a hemianopsia for colors (the frequence and importance of the latter as an early diagnostic sign of adjacent temporo-sphenoidal lobe abscess have not been previously recorded), are discussed.

It should be of service to the cranial surgeon, to the otologist and rhinologist; to the ophthalmologist because of its extensive discussion on the presence or absence of papilloedema; to any general surgeon who attempts an intradural operation; and to the neurologist and the general practitioner because of its diagnostic details.

This book is a distinct advance in the understanding of brain abscess and it will be a monument which will endure for a long period of time.

The Treatment of Fractures, with notes upon a few common dislocations, by Charles Locke Scudder, M.D., Consulting Surgeon to the Massachusetts General Hospital; formerly Assistant Professor of Surgery at the Harvard Medical School; Fellow American Surgical Association; Member of the American Society of Clinical Surgery. Ninth edition, revised, with 1,252 illustrations. Philadelphia and London: W. B. Saunders Company, 1922. Price, $8.50 net.

The issuance of a new edition of "The Treatment of Fractures" by Scudder will be welcomed by the profession, which has learned more and more to rely upon the teachings of this book as new editions have appeared. It is six years since the eighth edition was published, therefore this one embraces not only what has been learned with advantage from the civil practice but also the valuable knowledge acquired as the result of the experiences of the late World War. Infections of compound fractures have been practically eliminated by those who know how to use the Carrel-Dakin treatment properly; not only have infections been prevented, but also surgeons have learned how to clear up infected cases by this method, all of which is told in the text and the application of the tubes and dressings illustrated. It would have been to the advantage of the purchasers of the book if, instead of referring them for full details of this method to the small book, "Infected Wounds," by Carrel and Dakin, and to other sources of information, the author had used a couple of pages of text briefly but accurately to describe the method. These pages could be used to better advantage in that way than they are in the illustration of bone-drills, Lane's plates, etc.

An inspection of the text and illustrations shows how the Thomas splint and similar contrivances used for extension and suspension, with or without fixation, have in great measure revolutionized the treatment of all fractures of the long bones, both simple and compound, to the great advantage and comfort of the patients. There are only fifteen more pages in this volume than in the preceding one and in general few changes are noted; those made, however, are proven good ones.

At a recent consultation, in a distant farmhouse, with two country general practitioners, the writer overheard one of these gentlemen ask the other if he had seen Scudder's new edition of "The Treatment of Fractures." The reply was "I have it, and the chapter on Fractures of the Skull has been more than worth the price of the book to me," and so one might say of many of the chapters. These remarks are given in illustration of the widespread popularity of the book and how well it is appreciated by its owners. The text is readable and comprehensible, and the illustrations are in keeping with the text. Scudder's "Fractures" is too well known to require extensive review, and this ninth edition is better than its predecessors. John E. Summers, M.D.

The Surgical Clinics of North America, issued serially every other month (six numbers per volume). Octavo; illustrated, Volume 2, Nos. 4 and 5 (Boston number and Southern number, respectively). Philadelphia and London: W. B. Saunders Company. Cloth, $16; Paper, $12 per volume.

Eight of the sixteen contributors to No. 4 were among those who contributed to the former Boston number, of whom there were twenty-one. This number opens with a gynecological clinic for medical students by Dr. W. P. Graves, in which the histories and clinical examinations are developed in the presence of and with the assistance of students who are questioned as to the findings, the meaning of symptoms, their significance, and the probable diagnosis. It is real bedside instruction in which the student is taught to think for himself. It is a great relief to notice that in this particular clinic the laboratory findings are not overemphasized. This is a real clinic. Dr. W. C. Quinby gives another real clinic on "Renal Tuberculosis." All of the "Clinics" may be read with profit. Among those which particularly impress the writer is one by Elliott C. Cutler on "The Etiology of Postoperative Pulmonary Complications," his conclusions being in accord with the conclusions of those who have had most to do with this unfortunate complication, that "the majority of pulmonary complications are due to embolic from the field of operation. The result is either fatal pulmonary embolism or pulmonary infarction." Drs. Barney and Shedden present another, "A Study of Anesthesia in Prostatectomy," based upon 250 patients operated on in the Massachusetts General Hospital by five or six surgeons; the mortality of the group (18.8 per cent) is higher than obtains in most sections of the country, certainly so in the central west. An analysis of the relation of the kind of anesthesia employed hardly seems explanatory of the high mortality. When the authors state that pneumonia (pulmonary infection?) occurred in 13 per cent of the fatalities, and hemorrhage in 10 per cent, it would seem that possibly the preliminary treatment, operative technique, and post-operative handling of these 250 patients had not been quite in keeping with what is regarded today as essential for the best of success.

The Southern number seems to have been an experiment worth while. The contributors, fourteen in number, come from such widely separated parts of the country as Louisville, Richmond, New Orleans, Nashville, Birmingham, Raleigh, Temple and Galveston, Texas. It is pleasing to state that this number will compare favorably with any of its predecessors, both in the wealth of material and in manner of presentation. Dr. Matas opens the number with a very instructive report of two cases, one of special interest, an "Arteriovenous Fistula of the Femoral Vessels." In this instance he again shows himself the master in the surgery of the blood-vessels. Dr. Bradburn of New Orleans presents a case of Right Popliteal Aneurysm in which the restorative operation was done, and another case, Obliterative Endo-Aneurysmorrhaphy (Matas operation) for aneurysm of the superficial palmar arch. In this number as in others, Goitre, Duodenal Ulcer and Gastric Ulcer come into their own. How Cholecystectomy was left out is not explained, but it is a relief just the same. Dr. Thompson, of Galveston, describes and illustrates his well-known methods of doing Plastic Operations for Congenital Fissures of the Lip and Palate. He also presents an excellent clinic and pathological study of Tumors of Bone. One of the real valuable contributions is by Dr. Scott of Temple, in which he describes and illustrates his method of doing Cautery Dissections for Metastatic Cancer, particularly of the neck. Altogether, he has operated some 500 cases. He has learned that, where tension admits, these wounds may be closed as are those made by the knife, with resulting primary union. The text and illustrations of this article are really worth while.

John E. Summers, M.D.

An Outline of the Medical Service of the Theater of Operations, by **M. A. W. Shockley, Lieutenant Colonel, Medical Corps, U. S. Army.**

The routine of peace-time practice of medicine does not change largely from year to year. While this is true, with the advance in the science of war it is essential with those of us who are engaged in the practice of military medicine that we should keep abreast of the advancement made by our brothers in the line. Changes in tables of organization, in administrative duties and in the necessary replacement functions of the Medical Corps render it incumbent that the medical function of the combatant force shall keep pace with that of advance in other lines.

It is not a great while since the duties of the Medical Department were only loosely outlined and that there was no hard and fast rule to guide the medical officer in campaign except a certain God-given intuition which led him to be at the proper place at the proper time.

Since war has been brought to a very machine-made science and since medicine has found a larger place than giving cathartic pills or taking pulses, it is everywhere recognized that what was once a loose organization of relief to those who were stricken is now a very definite part in the accomplishment of victory or defeat.

Colonel Shockley in his work goes very definitely into this question of medical, scientific, reparative medicine and in his manual of 220 pages shows us very exactly the duties and responsibilities which devolve upon the military surgeon in time of active conflict. He is quite specific in the detailing of these, and for anyone who gives thoughtful consideration of what he has written there must be comprehension of the duties and responsibilities which rest upon any man in the Medical Corps, either lieutenant or colonel, in active wartime conditions.

The following is the contents of this most excellent manual which should be of much interest to regular officers, National Guard, and to the reserves:

I. General Organization and Functions of the Medical Department.

II. Data Relating to Casualties, Hospitalization, and Evacuation.

III. Medical Service of the Camp and March.

IV. Medical Service in Combat in Open Operation. General Considerations. Attached Medical Troops.

V. Medical Service in Combat in Open Operations. The Medical Regiment of the Division and Corps. The Army Medical Troops.

VI. Medical Service in Combat in Trench Operations. Disposal of the Dead.

VII. The Service of Collection, Evacuation of Casualties and Medical Supply with Cavalry Commands.

VIII. Orders for the Medical Service. Plan of Evacuation. Routine Camp Orders.

IX. Duties of the Division Surgeon and Medical Staff.

X. Duties of the Surgeon and the Medical Staff of an Independent Corps and Army.

XI. The Medical Department Functions and Duties of the Chief Surgeon of the Theater of Operations and Communications Zone.

This book may be obtained from The Association of Military Surgeons of the United States, Army Medical Museum, Washington, D. C. Price, $2.50 postpaid.

A Manual of Diseases of the Nose and Throat, by Cornelius G. Coakley, A.M., M.D., F.A.C.S. Sixth edition, revised and enlarged. Illustrated with 145 engravings and 7 colored plates. New York and Philadelphia: Lea & Febiger, 1922.

From the fact that this is the sixth edition of this work, its standard value, not only to the medical student but to those who practice this specialty, may be deduced. Dr.

Coakley's name stands out as one of those skilled particularly in his branch of the profession.

One of the most important points, from the standpoint of those who learn, is that his descriptions and rules in regard to the treatment of diseases within the limit of his elected line of work are definite, specific and final. There is no "guess" in what he says. He gives the result of a very practical and very successful experience in his own line and endeavors to impart to those who read his work a sure guide to an understanding necessary to carry out rational prophylaxis and treatment of the diseases of the upper respiratory tract.

Special attention is given to the practical features of Examination, Diagnosis and Treatment. As he says in his preface: "The importance of an accurate appreciation of the appearances found on examination cannot be overestimated, and no apologies are offered for the emphasis laid upon this phase of the instruction found in the following pages." Dr. Coakley, very rightly, does not rely entirely on methods of clinical examination but gives due credit to microscopical and bacteriological examinations in regard to the determination of the cause of diseased conditions. In light of modern medicine this is as it should be, since the eye of the observing physician must necessarily be linked, and associated with, the findings from the laboratory and from that of the radiologist.

In this sixth edition there is a new chapter upon the Diseases of the Nasal Vestibule. and additional articles upon Sinusitis in Children, Vincent's Angina, Parapharyngeal Abscess and the Direct Examination of the Upper Air and Food Passages.

The special chapter devoted to Therapeutics has been materially revised with a view to the introduction of newer remedies and to present the improved application of the older ones. Additional illustrations have been supplied, and many of the older pictures have been replaced by better ones.

Tonsillectomy and its complications are dwelt upon and further clarified by illustrations which the author has found useful.

The work comprises some 650 pages with 145 engravings and 7 colored plates. It is authoritatively written and, in addition to being a volume of instruction to the student who pursues this specialty, should be a valuable book of reference to anyone concerned with the treatment of the diseases with which it deals.

Lateral Curvature of the Spine, and Round Shoulders, by Robert W. Lovett, M.D., Sc.D., Boston; John B. and Buckminster Brown Professor of Orthopedic Surgery, Harvard University; Member of the International Society of Surgery; Member of the British, French, Italian and American Orthopedic Societies; Member of the Swedish Society of Medicine; Member of the Royal Society of Physicians of Budapest. Fourth edition, revised, with 172 illustrations. Philadelphia: P. Blakiston's Son & Co. Price, $2.50.

This well-known and appreciated monograph of 217 pages is dedicated to Prof. Vittorio Putti, Surgeon to the celebrated Rizzoli Orthopedic Institute at Bologna. Prof. Putti, it may be recalled, served as a colonel in the Medical Corps at the Italian front, and because of his particular ability was invited in 1919 to lecture both in London and New York on the Rehabilitation of the Disabled. The Institute Rizzoli is one of the best equipped hospitals in the world for the treatment of orthopedic cases, including, among many other kinds of apparatus, the Schulthess outfit for the treatment of scoliosis. In passing, it may be remarked that "Italian Surgery" by DeVecchi, recently reviewed in these pages, presents an enlightenment of the opportunities for the study of surgery in Italy, in all of the specialties, now not obtainable in Germany.

Dr. Lovett begins his monograph by giving an interesting short history of scoliosis, a term originating with Hippocrates, showing how the development of its treatment

brought down to date has resulted in the formation of two "schools" of practice: the one believing in forcible correction (a relatively modern treatment dating back only to 1875), and the other those who believe that gymnastic treatment affords the most promise. There are chapters upon the Anatomy of the Spine, including the normal physiological curves and movements; then follow descriptions of the mechanism of scoliosis, the symptoms and changes through transitional curves to the development of the organic or true scoliosis.

Under the head of Treatment the different gymnastic exercises are described and illustrated, as is also the employment of jackets and braces; then different methods of forcible correction and the way of sustaining the correction by jackets is explained. The different methods of correction are discussed and the choice for the particular patient indicated. The author says there are two kinds of correction, a real correction, demonstrable by the X-ray, and an apparent correction which is in reality only a rotation of the thorax on the spine—the body outlines are corrected but the X-ray proves the curvature of the spine unchanged. Scant space is given to the operative treatment for the stiffening in the spine; the techniques of Hibbs and Albee are mentioned but, as the author states, the spines are stiffened but the bodies rotate. Time will better tell the value of these procedures. The book is concluded by a chapter upon Faulty Attitude. The writer, having always had great confidence in the author because he is a scientific, practical orthopedist of wide experience, believes that this little monograph will be found, as have former editions, to teach what may be most safely followed in the handling of these often distressing deformities.

John E. Summers, M.D.

Bronchoscopy and Esophagoscopy; A Manual of Preoral Endoscopy and Laryngeal Surgery, by Chevalier Jackson, M.D., F.A.C.S. With 114 illustrations and four color plates. Philadelphia: W. B. Saunders Co.

Evidently Dr. Jackson knows his Burns. He states in his preface that the book is based upon an abstract prepared by a reader from his larger work. It was a happy thought to view his own more comprehensive work through other eyes. In so doing he could not help gaining perspective and proportion such as would not have been possible else.

He furtner says: "The author has endeavored, so far as lay within his limited abilities, to accomplish the difficult task of presenting by written word the various manual endoscopic procedures."

To those of us who have been privileged to see his skillful fingers at work and to listen to the man himself there comes an understanding of his meaning.

As

"Fancies fettered down by words,
Fall dumb to earth, as fettered birds"—

so no written word can replace the voice of the teacher nor picture supersede ocular demonstration. Add to these the personal factor, that something which makes the individual distinctive—and this Jackson possesses in high degree—and then we may understand that his apology is a real one and not a smirking, depreciatory gesture with a wish to gain applause.

To the student of his branch this book of Jackson cannot fail to be a delight. I am almost tempted to say that I know of no other textbook quite so satisfactory in subject matter and illustration.

In it one will find no waste of words, no lost motion, no evasion. One is reminded of Carlyle's comment on the literary style of Mahommed. No waste of words. Direct thrusts to the center of the subject. Like Mahommed he says "Assuredly!" not perhaps.

And to the student, to the one less skilled than himself, and for him the book is made, what a boon.

"Assuredly!" A few illustrative sentences will best show what I mean. Under the caption Tracheotomy he says: "Do it early. Don't wait for cyanosis. Never use general anesthetic on dispnoeic patient. Patient recumbent, sandbag under shoulders or neck. Nose to zenith. Keep in middle line. Expose isthmus of thyroid gland. Draw it upward or downward, or *cut it*. (Italics mine.) Don't give morphine." In the chapter on acquiring skill occur these aphorisms: "Educate your eye and your fingers. Be sure you are right, but not too sure. Follow your judgment, never your impulse. Cry over spilled milk enough to memorize how you spilled it. Let your mistakes worry you enough to prevent repetition."

Relative to illustrations, one must again use the superlative. They comprise one hundred and fourteen line drawings and half-tones in which no improvement is to be desired. There are in addition four colored plates made after the author's own drawings, in oil colors, from the living subject. These illustrate normal and abnormal conditions of the esophagus, larynx and bronchial tree, and add much to the usefulness of the work.

The type is large and clear and the printer's work in keeping with the book.

Clear, concise, emphatic, direct, authoritative—this book should be in the hands of every one who essays work in the field covered by it.

T. E. Oertel.

Le Problème Du Cancer par William Seaman Bainbridge, A.M., ScD., M.D., C.M., LL.D., Professeur de chirurgie à la New York Polyclinic Medical School and Hospital, Chirurgien et secrétaire des recherches au New York Skin and Cancer Hospital, Chirurgien consultant Manhattan Hospital, Ward's Island, Président honoraire de Congrès International d'Heidelberg, 1906, pour l'étude des tumeurs et du cancer, Medical Inspector, Commander U. S. Navy, Reserve Force, Délégué officiel des Etats-Unis au Congrès de médecine et de pharmacie militaires, tenu à Bruxelles, en 1921, Membre correspondant étranger de l'Académie Royale de Médecine de Belgique, Officier de la Légion d'Honneur. Traduit de l'Anglais par le Dr. Hertoghe, d'Anvers, Membre titulaire de l'Académie Royale de Médecine de Belgique, d'après la première édition de la Macmillan Company de New York. Revue et mise à jour par l'auteur. 24 p.p., 484 pp. 37 pl., Louvain, A. Uystpruyst, éditeur Librairie Universitaire, 10, rue de la Monnaie; Paris, O. Doin, éditeur, 8, place de l'Odeon, 8, 1922.

Of all the problems concerning human health and physical welfare to which man gives the most serious and painstaking attention, none has more completely baffled all attempts at solution than that of cancer. Of the pathology of this malady in its various forms considerable is known; in the matter of its treatment operative surgery and radiotherapy offer hope, if employed sufficiently early; certain factors contributing to the production of the condition have been defined; but the fundamental, definitive, or specific cause of cancer still hides within the folds of a mystery as impenetrable as ever. The vast amount of research work now being applied to the study of cancer and the enormous volume of literature which annually appears in all languages concerning it speak eloquently of the dread in which the disease is held by mankind and of the interest which it continually arouses in all biologists.

Dr. William S. Bainbridge has given to medical literature a study of "The Problem of Cancer" which has the honor of having been translated into French within the last two years. This translation, having been made by Dr. Hertoghe, to whom French is at least one of his native languages, leaves nothing to be desired from the rhetorical point of view. The book begins with a historical summary of the development of cancer research both in the United States and in other countries. The first chapter concerns itself with cancer in the vegetable world and draws certain analogies between such phytopathologic manifestations and the disease as seen in man. The zoölogy of cancer and its occurrence in the various families of the animal kingdom are followed by a chapter upon its geographic and ethnologic distribution. The chapter on the statistics of cancer, while insisting upon the importance and value of statistical study, admits very frankly the errors which may possibly creep into such an investigation. The mortality from cancer is considered in its numerous aspects. Two chapters are given up to the etiology of the disease and these are followed by a profusely illustrated description of the histopathology. The modern investigation of malignant disease; with especial reference to experimental cancer resulting from transplantation and from other causes, is very adequately treated. The clincal side of the disease, its diagnosis and diagnostic errors, make up the subject matter of three chapters. In a chapter on prevention a list of precancerous lesions is given, and it is earnestly urged that early and careful attention be paid to the eradication of these. The medical treatment of the disease includes discussions of the therapeutic application of enzymes, sera, vaccines, turpentine, sodium oleate and electricity. The non-operative treatment of the disease is handled in chapters on "Caustics or escharotics," "Physiotherapy" (including radiotherapy), and "Biotherapy." The surgical treatment of the disease includes a very extensive table showing the results of "Ligature of the arteries and blocking of the lymphatic channels in inoperable cancer of the pelvic organs." This table gives:

1. Name of patient.
2. Age of patient.
3. Hospital where treated.
4. Diagnosis.
5. Date of operation.
6. Lesions definitely located in the course of laparotomy, together with palliative measures other than arterial ligation and blocking of the lymphatic channels.
7. Names of arteries ligated.
8. Effect of operation on (*a*) pain, (*b*) fetor, (*c*) secretions, (*d*) hemorrhage, (*e*) extension of the disease, (*f*) general condition.
9. Results.
10. Remarks.

To the discussion of inoperable cancer in general one chapter is given, and this is followed by a reference to the hospitalization of cancer patients. The book is concluded by an impressive discussion of the necessity of educating the public concerning cancer and a word of hope for the future control of the disease, even though a definite solution of the problem of its etiology is not yet in sight.

All in all, this work gives a very valuable survey of the whole field of cancer, and cannot but be of high value for purposes of reference to those foreign workers who think in French, and whose command of English is not such as to enable them to appreciate the finer shades of meaning in a discussion of abstruse scientific problems. The author is to be congratulated upon being admitted to the ranks of those men of medicine in our land whose writings have been deemed worthy of translation into the languages of older civilizations. A. N. Tasker.

A Textbook on Gonorrhea and Its Complications, by Dr. George Luys, late assistant to the Urological Clinique, Hôpital Lariboisière, Paris, Prizeman of the Faculté de Médecine, Paris, Chief Medical Officer of the Urological Centre at the Military Hospital, Versailles. Translated and edited by Arthur Foerster, Captain R. A. M. C. (T. C.), M. R. C. S., L. R. C. P. (Lond.), Late Resident Medical Officer, London Lock Hospital. Third revised edition with 212 illustrations and 5 colored plates. 8°, pp. xvi+400. New York: William Wood and Company, 1922.

As between gonorrhea and syphilis it is difficult in the minds of many urologists to determine which of the two results in more widespread and persistent evil in the matter of sequelæ. However the question may finally be decided, it is beyond argument that gonorrhea is one of the most serious of all the infections with which medical science has to deal. The old days when braggadocio youth proclaimed that it would "rather have gonorrhea than a bad cold" may be safely assumed to have passed forever. It is rare indeed in these times to find a layman or a laywoman of any age above that of childhood who has not some just notion of the seriousness of the malady in question.

Whereas previously gonorrhea was but infrequently made the subject of separate treatises, being discussed generally in textbooks on urology or on the whole group of venereal diseases, in more recent years the disease has seen built up around it a mass of literature in which its individual importance is duly recognized.

The book here under review treats the subject with which it deals in a wonderfully complete and detailed fashion as indicated by the following table of contents:

I. The History of Gonorrhea.
II. The Dangers of Gonorrhea.
 The Social Struggle against Gonorrhea.
 The Legal Aspect of Gonorrhea.
III. The Etiology of Gonorrhea.
 The Gonococcus.
 Inoculation.
 The Toxin of the Gonococcus.
 Biology of the Gonococcus.
 Localization of the Gonococcus in the Human Body.
 Gonococcal Septicemia.
IV. Inflammations of the Urethra Due to Other Causes than the Gonococcus.
 Inflammations of the Urethra due to Common Micro-organisms.
  Primary Urethritis of Bacterial Origin.
  Secondary Urethritis of Bacterial Origin.
 So-called "Aseptic" Inflammations of the Urethra.
 Inflammations of the Urethra due to Chemicals.
 Inflammations of the Urethra due to a Special Diathesis.
 Inflammations of the Urethra due to Toxins.

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7. Electro-Coagulation.
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11. Salves and Urethral Suppositories.
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Résumé of the Treatment of Chronic Urethritis.

One notable and extremely valuable feature of this work consists in the great number of illustrations which punctuate the printed text. Many of these which deal with the gross pathology as directly viewed by cystoscopy and urethroscopy are in colors, and present to the student an unusually exact picture of the conditions which will confront his eye when he comes to concern himself with the clinical management of gonorrhea, whether it be in man or in woman.

No more complete and generally valuable work on this subject has come to the office of the Military Surgeon, and it cannot be too highly recommended, whether as a textbook for the medical student or a reference work for the general practitioner and the urological specialist.

A. N. TASKER.

SYPHILIS, by Burton Peter Thom, M. D., Visiting Syphilologist to the Hospitals of the Department of Correction, Welfare Island, New York City. Illustrated, 69 engravings; 8°, x+525 pp. Philadelphia and New York: Lea & Febiger, 1922.

It is probable that the origins of no single disease have more intrigued the interest and curiosity of medical historians than those of syphilis. It was long held in Europe that this was a malady native to the new world, and that it had been originally introduced into Europe by the sailors of Columbus returning from their voyages of western discovery. Some color was perhaps lent to this view by the fact that waves of active syphilitic infection swept over Europe, perhaps for the first time in epidemic form, in the Middle Ages. Garrison states[1] that the malady "was supposed to have first appeared in epidemic form at the siege of Naples in 1495 and to have been communicated to the French invaders by the Spanish occupants, who got it (authorities conjecture) from Columbus's sailors, a visitation from the new world." More latterly, however, the opinion has been gaining ground that syphilis is of prehistoric origin, that it was harbored by all the peoples of antiquity, and that the recrudescence of its activities among European races shortly after the discovery of America was of the nature of a coincidence, and was not based upon its transmission from a distant endemic focus to a geographical area from which the causative parasite had hitherto been excluded. The scholarly researches and unanswerable arguments of Professor Sudhoff along this line of medico-historical investigation have made him the leader in, and largely responsible for, the quite general acceptance of the present-day views concerning the status of syphilis among the peoples of the old world during antiquity.

The theory as to the etymology of the word "Syphilis" (namely, that it is derived from the two Greek words *σύν*, *with*, and *φιλεῖν*, *to love*), to which Dr. Thom subscribes is certainly as good as, if not better than, any other. His remark that "from this its venereal origin is obvious" is itself an obvious conclusion.

That prehistoric man (the aboriginal inhabitant of the American continents as well as of Europe, Asia, and Africa) was the victim of syphilis seems quite definitely established from a consideration of certain pathological lesions of bones and mummies described by not a few investigators. A disease (or diseases) which might well have been syphilis in some of its modalities is to be found mentioned in the oldest Chinese medical writings, in the Ebers Papyrus, on the clay tablets unearthed from the Library of Assur-Ban-I-Pal, King of the Assyrians, and in portions of the Bible, especially those dealing with the Mosaic period. Hippocrates, Galen, Celsus, Dioscorides, and Horace all describe lesions of the skin, mucous membranes, and other tissues, which may very reasonably be looked upon as manifestations of syphilis. Moreover, references not dissimilar in nature may be found widely scattered throughout the medical writings of the Middle Ages. Thus it seems that the early origins and the continuity of lues among the populations of both hemispheres may now safely be taken as established facts. Later names indissolubly linked with this disease in one phase or another are those of

[1] Garrison, F. H.: History of Medicine, 3d ed. Philadelphia: W. B. Saunders Co., 1922, p. 181.

John Hunter, Phillippe Ricord, Rudolph Virchow, Pasteur, Schaudinn, Hoffmann, Wassermann, Ehrlich, and Noguchi.

While much regarding the pathology, the clinical manifestations, and the treatment of syphilis was known in the days of Hunter, Ricord, and Virchow, nevertheless it is entirely fair to claim that a very large part of the knowledge which we possess today regarding latent syphilis, the hereditary element in its transmission, its specific cause, its diagnosis in periods of quiescence, its more remote sequelae, and its therapy, depends upon three factors, all of which are attributable to the period of our own generation. These are (*a*) the discovery of *Spirochatea pallida* by Schaudinn and Hoffman in 1905, (*b*) the development in 1907 of the serodiagnostic test which now bears the name of the "Wassermann reaction," and (*c*) the great advance in the chemotherapy of the disease made by Ehrlich when in 1910 he added salvarsan to the anti-syphilitic armamentarium.

Experimental investigations of syphilis have engaged the attention of great numbers of workers, and from these labors has come our knowledge concerning the impossibility of secondary inoculation during the active and latent periods of the disease, the possibilities in the matter of prophylaxis, and the constitutionality of the infection.

Syphilis of the nervous system is by no means a necessarily late manifestation of the disease. Furthermore, syphilitic involvement of this system is not rare, as shown by the fact that from one-fourth to one-third of all syphilitics give positive evidence in the cerebrospinal fluid of nervous invasion within one year from the appearance of the chancre. Not all such individuals will either soon or later become victims of the different clinical manifestations of neuro-syphilis; yet each one must be looked upon as in potential danger of some of the local paralyses, of tabes, or of general paralysis, which are the severest of the disorders of the nervous system dependent upon luetic involvement. It thus becomes of prime importance that the clinician give especial attention to each patient to the end that he may make himself aware of the earliest indications of cerebrospinal lues, either through a recognition of its more shadowy clinical evidences or by an examination of the cerebrospinal fluid.

Of the actual transmission of syphilis from mother to foetus there is all necessary and indubitable proof, but the possibility of the transmission of syphilis from a first through the second to a third generation is the subject of a question which has called forth an extraordinary amount of heated argument pro and con. Certain details of our knowledge concerning the effects of congenital syphilis in the second generation upon the general health, and consequently upon the expectation of life and upon the procreative capacity of the victim, would tend to cast a serious doubt over the probability of such victim ever playing the rôle of an intermediate host in the transmission of the disease from grandparent to grandchild. Again, connubial infection seems, except in rare instances, to pass away in about ten years, and this fact would tend to negative the likelihood of any congenital syphilitic arriving at the usual age of procreation in such stage of the disease as to make its transmission to offspring possible, or, at least, probable. Yet, on the other hand, so many careful observers have recorded cases in which they considered the transmission of the disease to the third generation conclusively proven, that it is certainly not now possible to deny definitely this hypothesis.

That all such inherited syphilis of the third and later generations manifests itself by the appearance of the usual active lesions is probably not true. Rather does the specific taint tend more latterly to produce those congenital abnormities and degenerative dystrophies for which pathologists have so long unsuccessfully sought some other adequate explanation. It may not be without the bounds of possibility that a later day shall see proof adduced that many so-called "predispositions," such as that which has been long assumed in connection with the tuberculosis of childhood, depend upon ancestral syphilis.

No disease is more protean in its manifestations and in its influence upon all phases of human activity. Sociology, politics, economics, industry—all are colored and tinctured by it, and all have an interest of indeterminate extent in its suppression. To all those who look upon this malady as the greatest scourge of the human race one paragraph in Dr. Thom's very timely, very complete, and very valuable work on the subject will stand out as a beacon light of hope;—"Some day—and it is not, I think, far distant—the last page in the history of syphilis will be written. Slowly but surely the disease is being conquered. Soon it will pass, and then will be lifted the heaviest curse that ever banned the sons of men."

A. N. Tasker.

A Textbook on Minor Surgery, by Dr. John C. Vaughan, Director and Visiting Surgeon, Beekman Street Hospital; Visiting Surgeon, Sing Sing Prison Hospital; Consulting Surgeon, Manhattan Eye and Ear Hospital; Consulting Surgeon, Workers' Health Bureau; Former Visiting Surgeon, Bellevue Hospital, and Chief Vanderbilt Surgical Clinic, and Instructor in Minor Surgery, Columbia Medical College; and by Dr. Athel Campbell Burnham, Colonel in United States Army; in charge of the Medical Department of Red Cross in Poland; Attending Surgeon, Volunteer Hospital; Former Attending Surgeon, Department of Surgery, Vanderbilt Clinic, College of Physicians and Surgeons; Former Instructor in Surgery in the Polyclinic Hospital. Illustrated with 459 engravings; xix+627 pp. Philadelphia and New York: Lea & Febiger, 1922.

The term "Minor Surgery" has until recently been employed to denote a rather limited, though not very definite, field of surgical activity. In this work on minor surgery by Drs. Vaughan and Burnham the phrase is used in a much more comprehensive sense, and not a few surgical measures which were formerly left for discussion entirely to the larger textbooks on surgery have been included herein. A survey of this work indicates that it has been prepared especially with the medical student in mind, for rhetorically it is characterized by that sufficiency of detail coupled with simplicity and clarity of expression which all teachers look upon as essential in lectures and literature destined for the ears and eyes of those who approach the subject under discussion for the first time.

The first chapter deals with "General injuries to the soft parts," which are handled as to etiology, diagnosis, and treatment under the subdivisions of abrasions, contusions, hematoma, wounds, subcutaneous injuries, burns and scalds, effects of intense cold, and specific infections. The second chapter concerns itself with fractures and is followed by a chapter on "Injuries to joints." In this latter, dislocations, sprains, traumatic synovitis and wounds are discussed. In a chapter on "Inflammation, suppuration and gangrene"

very careful and well-balanced descriptions of the use and therapeutic value of the newer as well as the older antiseptics are given. Under the general heading of "Injuries to the head" there are to be found descriptions of abrasions of the face and scalp, contusions of the scalp, hematoma of the scalp, contusions of the face, foreign bodies in the head and face, wounds of the head and face, burns of the head and face, fractures of the skull, fractures about the face, inflammation of the head and scalp, septic infections of the face and scalp, benign tumors of the head, calculi of the mouth, benign tumors of the face, malignant tumors of the head and face, and plastic surgery of the face. A chapter on "Injuries and inflammation of the neck" in which those pestiferous scourges of mankind, boils and carbuncles of the neck, are very rationally and conservatively referred to, is followed by a consideration of "Special surgical conditions of the trunk." In this connection herpes zoster is not considered outside the realm of surgery. The minor surgery of pleurisy and empyema is so described as to be of particular value to the student. Surgical conditions of the breast, tuberculosis of the trunk, surgical conditions of the umbilicus, tumors of the trunk, and fractures and dislocations of the trunk are featured. "Fractures and dislocations of the hand and arm," "Injuries of the hand and arm," "Acute infections of the upper extremity," "Miscellaneous infections of the hand and arm," and "Tumors and deformities of the hand and arm" are the headings of chapters in which a most useful compendium of the minor surgery of the upper extremity is included. Broadly speaking, the lower extremity is treated in the same way with minor changes as to arrangement and chapter headings. One chapter is devoted to "Affections of the rectum and anus," while the two succeeding chapters concern themselves with the diseases and abnormalities of the external organs of generation, both male and female, including the vagina. All forms of bandages and the methods of their application are minutely described. In the chapter on local anesthesia detailed technique is given for those procedures which have in view the use of local anesthesia. A chapter on "Special minor operations" is subdivided into "Hypodermic injections," "Intramuscular injections," "Intravenous infusion," "The injection of arsphenamine," "Lumbar puncture," "Intravenous medication," "Paracentesis of the abdomen," "Hypodermoclysis," "Phlebotomy," Withdrawal of blood specimen," "Blood transfusion," and "Skin grafting," while the book concludes with a final chapter on "Surgical technique and supplies."

The element of illustration has been anything but neglected in this treatise. Of those inserted a few are diagrammatic anatomical representations taken from Gray's Anatomy, a few more are likewise diagrammatic in character and taken from other sources, but the great majority (fully 95 per cent or more) are reproductions of photographs or Roentgenograms. They have all been carefully chosen, and each one is valuably illustrative of the textual description to which it refers.

Both the limits of minor surgery and its broadened scope have been more clearly defined in this volume than in any other textbook on the subject with which we have compared it. It is a production of great value and is to be highly recommended for the use both of medical students and general practitioners.

A. N. Tasker.

Obituary

Those of our membership whose deaths have been noted since our last report are as follows:

Col. Alfred E. Bradley, M.C., U.S. Army
Major Daniel S. Burr, M.C., N.Y. N.G.
Major John H. Claibourne, M.C., N.Y. N.G.
Major F. C. Floeckinger, M.C., Texas N.G.
Capt. Samuel R. W. McCune, M. C., U.S.A.
1st Lieut. John C. Whiteaker, M.R.C., U.S.A.

THE
MILITARY SURGEON

VOL. LII MARCH, 1923 NUMBER 3

SHALL SEX HYGIENE BE TAUGHT IN THE PUBLIC SCHOOLS?[1]

BY LEE ALEXANDER STONE, CHICAGO, ILL.
Major, Medical Reserve Corps, United States Army

"Sexual hygiene in the full sense—in so far as it concerns individual action and not the regulative or legislative action of communities—is the art of imparting such knowledge as is needed at successive stages by the child, the youth and maiden, the young man and woman, in order to enable them to deal rightly, and so far as possible without injury either to themselves or to others, with all those sexual events to which every one is naturally liable. To fulfill his functions adequately the master in the art of teaching sexual hygiene must answer to three requirements: (1) he must have sufficient knowledge of the facts of sexual psychology, sexual physiology and sexual pathology, knowledge which, in many important respects, hardly existed at all until recently, and is only now beginning to become generally accessible; (2) he must have a wise and broad moral outlook, with a sane idealism which refrains from demanding impossibilities, and resolutely thrusts aside not only the vulgar platitudes of worldliness, but the equally mischievous platitudes of an outworn and insincere asceticism, for the wise sexual hygienist knows, with Pascal, that 'he who tries to be an angel becomes a beast,' and is less anxious to make his pupils ineffective angels than effective men and women, content to say with Browning, 'I may put forth angels' pinions, once unmanned, but not before;' (3) in addition to sound knowledge and a wise moral outlook, the sexual hygienist must possess, finally, a genuine sympathy with the young, an insight into their sensitive shyness—comprehension of their personal difficulties, and the skill to speak to them simply, frankly and humanly."—*Havelock Ellis*, "The Task of Social Hygiene."

CHICAGO public schools are preparing for another Waterloo. Superintendent Mortenson is to start a moral squad to work on sex instruction. The mere fact that the word "morals" is prominently used spells for Mr. Mortenson's campaign "defeat." "Morals" as a word savors of puritanism, chicanery and, worst of all, it is the reformer's biggest shell, to be fired from what he conceives to be a big gun, but which, in reality, is of a smaller bore than the old-fashioned "Flobert" rifle carried by the boy and with which he, in youthful dreams, plans to kill lions and tigers and, perhaps, an elephant. Why harp on morals when every one knows that, for centuries, censors of all kinds have

[1]Read before Illinois Association of Military Surgeons, November, 1922.

abounded to the public discomfort and have burned at the stake or put on the rack those whose conception of human behavior differed from theirs. Teaching morals has not nor will it ever improve one iota man's condition, until he is educated to see the need for such improvement by surrounding himself with a favoring environment which must emanate from the home.

Mr. Mortenson speaks of teaching civics. Splendid! Increase civic pride in the hearts of the citizens of any country, city, or township, and you immediately cause to be developed a pride in the hearts of those citizens and a desire to reach higher ethical standards, not moral, if you please. Teach social ethics and civics, but for the good of the community refuse to have aught to do with those who come in sheep's clothing and profess to teach morality.

Morality may be acquired only through the development of civic pride, by seeing that all parents receive at the hands of competent teachers, who are well grounded in biology, zoology, anthropology, ethnology, sociology and, what is best of all, who possess a knowledge of psychology sufficient to understand fully and appreciate parental needs, a type of training that will enable them to return to their firesides and give to their children the fruit of what they have learned.

No more dangerous project was ever entered upon by a pedagog than that which has to do with the vital spark of sex and the teaching of the young certain facts that are not possessed by parents; namely, that phase of social science called sex hygiene.

Chamfort, more than a century ago, aptly said, "People are always writing about education, and their writings have led to some valuable methods. But what is the use, unless, side by side with the introduction of such methods, corresponding reforms are introduced in legislation, in religion, in public opinion? The only object of education is to conform the child's reason to that of the community. But if there is no corresponding reform in the community, by training the child to reason, you are merely training him to see the absurdity of opinions and customs consecrated by the seal of sacred authority, public or legislative, and you are inspiring him with contempt of them." These are strong words and are worthy of deep contemplation.

Those advocating the teaching of sex hygiene in the public schools would do well to bear in mind that many whose children are at present depending on the school board for guidance, might, because of their antipathy towards such a scheme, decide to withdraw their children and send them to parochial schools or private schools instead. There can be no question but that such a move would cause consternation. Yet it must be borne in mind that parents are responsible for the actions of

their children and are privileged to send them to whatever school they may elect as being of the proper sort to equip them with academic training sufficient for their needs.

There are hundreds of thousands of parents over the United States who believe, and rightly, that the teaching of sex hygiene to children in any other place than the home constitutes a dangerous blunder—a blunder fraught with serious possibilities for society.

The fact that there are many parochial schools over the United States does not mean that they are all controlled by the Catholic Church; Lutherans, Seventh Day Adventists, Mennonites, and, in some places, Episcopalians maintain schools for their parishioners. These schools are run on the same high plane as Catholic schools are run. Children attending them receive the most careful training that can be acquired by the youth and maiden.

I believe in our system of public schools, but I object most strenuously to the faddism that is at present creeping into them. This faddism is nothing more than the outcropping of political chicanery, used for the purpose of keeping some political machine in power. Let pedagogs and politicians look for novelties and introduce innovations in the public schools which are harmless, but, for the sake of society, force them to keep "hands off" when over-zealous amateurs and, in some instances, experts advocate so dangerous a project as teaching sex hygiene to the young.

There are attending Catholic parochial schools in Chicago, 142,603 children. The attendance at these schools is, as you can see, very large, and yet never once has the subject of sexual hygiene ever been broached, nor has the teaching of it ever been advocated by those in charge. The reasons given are that children attending these schools seldom need it. Those in authority realize that Catholic mothers and fathers bring their children up to respect something that is sadly lacking among children of most Protestant parents, namely, respect for parental authority. In days gone by every child felt that the word of a parent was law. Now they scoff at it. This circumstance is unfortunate, for with the present day failure on the part of those who have children to enforce their authority and to demand the respect they are entitled, they are laying up for themselves trouble that may bring about a racial decadence which will undo the efforts of those whose chief aim in life has been to promote civilization, and thus erect a national structure which will outlast all time. The parochial schools seldom have had to contend with any major sex problems, nor has there been great evidence of licentiousness among the pupils for whose behavior the teachers in these schools are responsible. It is a pity that a

similar statement cannot be made about public schools in America, whose control is in a large measure placed in the hands of political appointees. There is hardly a public high school in the United States but what has had develop in it some evidences of a loose moral code existing among some of the pupils in attendance. A part of this is chargeable, at least I believe, to what I have already pointed out—lack of respect for authority on the part of children. Parents fail in their obligations to their children and allow too much license today. No attention is paid to chaperonage and children are allowed to run loose, with the consequence that evidences of sexual misbehavior are frequently unearthed. There is too much laxness allowed by parents in the way female children dress today. The average girl insists that she must wear what was yesterday considered her best dress, to school. Silk stockings are worn everywhere, no child considering herself properly dressed unless these are in evidence. Simplicity in dress is no longer the vogue. All of this makes for vanity and conceit and establishes a desire in the minds of the young—a feeling that as long as they wear fine raiment nothing else matters. For years certain people have been advocating a uniform to be worn by girls attending high schools and also the seventh and eighth grades of the grade schools. This is an innovation worth while trying. When all children attending high schools are made to wear the same kind of clothing, then will be noticed a greater desire on the part of students to attend to their studies rather than to themselves as is at present the style. Instead of painting their cheeks and lips a vermillion hue and using too much powder and charcoal, which makes them look in some instances like circus clowns, they would allow nature to take its course and put natural color where color was rightly needed. The paint, powder and charcoal craze has made many an innocent and splendid girl look like a demimondaine of the old days. This fact has caused her to be insulted on more than one occasion.

Havelock Ellis, possibly the world's greatest sex psychologist, wisely says, in "The Task of Social Hygiene":

> By introducing sexual hygiene we are breaking with the tradition of the past, which professed to leave the process by which the race is carried on to Nature, to God, especially to the devil. We are claiming that it is a matter for individual, personal responsibility, deliberately exercised in the light of precise knowledge which every young man and woman has a right, or rather a duty, to possess. That conception of personal responsibility thus extended to the sphere of sex in the reproduction of the race may transform life and alter the course of civilization. It is not merely a reform in the classroom; it is a reform in the home, in the church, in the legislature. If sexual hygiene means that, it means

something great, though something which can only come slowly, with difficulty, with much searching of hearts. If, on the other hand, sexual hygiene means nothing but the introduction of a new formal catechism, and an occasional goody-goody perfunctory exhortation, it may be introduced at once, quite easily, without hurting any one's feelings. But really, it will not be worth worrying about one way or another.

The problem of sex hygiene is not one that may readily be solved. It has to do with the finer and higher things of life to which the average individual has paid but little if any attention. To teach one child and not all means that those who have received instruction are bound sooner or later to come into contact with degenerating forces which emanate from outside the home. These forces are hard to combat. Wherever ignorance is, there is bound to be grossness which has certainly no place among elements which should make for a higher idealism. Ignorant parents who in turn were brought up by ignorant parents need instruction that will give to them a cleaner and more wholesome outlook on life, particularly as to its real meaning. The reproductive impulse is possessed by every animate thing, no matter whether that thing be a blade of grass, a grain of corn, or one of the lower forms of amoeba. Man with his colossal ego has evolved a most dangerous philosophy, that of taking unto himself the credit of being the greatest and the most important factor among all those things which possess life and reproduce their kind. In this he is mistaken; he is merely a cog which, if it slips or breaks, is immediately replaced by another cog, and the great biologic factors which give and constitute life continue to function just as well without him. Man should bear in mind that, were the reproductive function not possessed by lower forms, he would cease to live. He is entirely dependent on the bounty of nature to enable him to keep up body energy sufficient to reproduce his own kind.

The failure to appreciate the above statement on the part of man has made of him a creature controlled largely by whims and fancies.

Man to live must have a respect for and must encourage reproduction and feel a deep regard for it in his soul or else he must die. His dignity lies in his free-will and intellect, which he has the right to use and direct.

Undoubtedly, as Ellis says:

We have amongst us many mothers, teachers, and physicians who are admirably equipped to fulfill their respective parts—elementary, secondary and advanced—in the work of sexual hygiene. But so long as they are few and far apart their influence is negative, if it is not even rendered harmful.

He again says:

It must often be useless for a mother to instill into her little boy respect for his own body, reverence for the channel of motherhood through which he entered the world, any sense of the purity of natural functions or the beauty of natural organs, if outside his home the little boy finds that all other little boys and girls regard these things as only an occasion for sniggering. It is idle for the teacher to describe plainly the scientific facts of sex as a marvelous culmination in the natural unfolding of the world if, outside the schoolroom, the pupil finds that, in the newspapers and in the general conversation of adults, this sacred temple is treated as a common sewer, too filthy to be spoken of, and that the books which contain even the most necessary descriptions of it are liable to be condemned as "obscene" in the law courts. It is vain for the physician to explain to young men and women the subtle and terrible nature of venereal poisons, to declare the right and the duty of both partners in marriage to know, authoritatively and beforehand, the state of each other's health, or to warn them that a proper sense of responsibility towards the race must prevent some ill-born persons from marrying, or at all events from procreating, if the young man and woman find, on leaving the physician, that their acquaintances are prepared to accept all these risks, light heartedly, in the dark, in a heedless dream from which they somehow hope there will be no awful awakening.

The moral to which these observations point is fairly clear. Sex penetrates the whole of life. It is not a branch of mathematics, or a period of ancient history, which we can elect to teach or not to teach, as may seem best to us, which if we teach we may teach as we choose, and if we neglect to teach it will never trouble us. Love and hunger are the foundations of life, and the impulse of sex is just as fundamental as the impulse of nutrition. It will not remain absent because we refuse to call for its presence; it will not depart because we find its presence inconvenient. At the most it will only change its shape and mock at us from masks so degraded, and sometimes so exalted, that we are no longer able to recognize it.

Not many school teachers possess knowledge of the processes of reproduction or of biology, let alone of parentology. Frequently they are biologic non-essentials in that they never have enjoyed the privileges of parenthood. All they know about sexual hygiene has been gleaned from sex novels, sex plays, the daily press, sex cinemas, and from too much reading of books written by writers who pose as disciples of Freud. Freudian literature at present is in great demand. Those who read it in most instances do so for the "thrill" they expect to get out of it. It excites libidinous thoughts in them which in most instances are never gratified legitimately, if ever at all, except through the development of a dream complex wherein the biologic urge is not satisfied. I can imagine no more disastrous thing that could happen to a child attending a public school than to have it taught sexual hygiene in a perfunctory manner by a spinster or by a bachelor. Certainly those

who are to teach this most important phase of social psychology should have a background of education sufficiently broad to enable them to speak, as one possessed of natural knowledge and not in the abstract.

Moral lectures should be taboo. Children should be made to appreciate that in their bodies is carried a seed which if cared for properly will, when the mating time of their lives comes, and they feel the strong biologic urge of love and can no longer resist the temptations promised by marital companionship, that their one aim should be that of reproducing a being in their own likeness who some day will amount, as a civilizing force, to more than their parents ever have amounted to.

Merely to tell a child to be a good little boy or a good little girl is to wound their feelings in a way they will never get over. Strong, forceful, plain and yet delicate language spoken with authority carries a great deal further with children than all the moralizing phrases ever used by the individual more bent on airing his own personal prejudices than he is to get over the big message of life.

The greatest failure of Mrs. Ella Flagg Young's administration was in the "Purity Campaign" she waged in Chicago's Public Schools in 1913–1914. Inexperienced teachers and lecturers were responsible for this failure. Many did not understand the work assigned to them and therefore made a botch of it. This very failure should make the school board more careful in its proposed campaign. To term lectures on sexual hygiene "Purity Lectures" or "Morality Lectures" is to wave a red flag in the face of most parents who already are questioning the move on the part of the school board.

Purity, as Havelock Ellis puts it, is ("Little Essays of Love and Virtue," Doran):

> Purity, we thus come to see is, in one aspect, the action of sublimation, not abolishing sexual activity, but lifting it into forms of which our best judgment may approve. . . . But there are limits to such guidance, for the primitive human personality can never be altogether rendered an artificial creature of civilization. When these limits are reached the transmutation of sexual energy may become useless or even dangerous, and we fail to attain the exquisite flower of Purity.

Life is like the unfolding of a beautiful flower that has been raised by the careful hand of a lover. Life is clean and fit to live. It is too short, however, for ignorance. The great lessons of life relating to reproduction should be taught in the home and not, for the present at least, in the schoolroom at the hands of inexperienced teachers. Let enthusiasts who believe they have a message go into the highways and byways and first instruct ignorant mothers and fathers in social ethics, civics, and especially in sexual hygiene that they may be conversant

with the problems of childhood in order that their progeny may receive at their hands, when very young, a story of their birth which will raise their ideals and cause them to have a wholesome respect for the greatest of all wonder workers—the reproductive impulse.

Children should be taught that marriage is a sacrament and that the love impulse is too holy to be tampered with. This fact should be impressed upon the minds of the young by the clergy, by physicians, nurses, teachers, and especially by parents in whose hands is placed the shaping of the characters of those for whose existence they are responsible. In other words virtue, once implanted, deals with difficulties by its own strength. It is unfortunate that the day of religious training seems to have been slighted. The old days, when family prayers were said every evening and where a lesson from the Scriptures was carefully and respectfully discussed by parents before their children, have to a large degree passed. In other words, the coldly material things incident to an everyday business life hold sway, and man is too busy to think of his God except on Sunday or when he occasionally attends church.

This is not the time to discuss religion. I would like, however, to say that, if there were more spirituality in the world, there would be a greater incentive towards more decent living and respect for parental authority than exists at the present time.

The Rev. Hon. E. Lyttelton wisely says:

> Every year scores and scores of children are born into the world with certain very beautiful and clearly marked characteristics. They are innocent of impurity, indescribably eager for wholesome knowledge, perfectly trustful of their parents, and, though self-absorbed, are capable of being easily trained to a tone of mind to which sympathy is congenial and cruelty is abhorrent. Such a description is literally true of the great majority of quite young children, and we believe that qualities such as these elicited the great saying, "Of such is the kingdom of heaven!"

The Rev. Father Thomas J. Gerrard makes a statement in his introduction to his book, "Marriage and Parenthood," which strikes a note that should meet with the approval of all those who think:

> The Church guards a divine ideal—that is why she is always right. A nation's decadence consists not so much in the actual lowering of its moral life as in the lowering of its ideal. If it preserves its ideal there is hope of its resurrection. But, if it calls good bad and bad good, then its doom is sealed.

The World War has caused many to believe that idealism is dead, but let us pray that such is not the case, for without idealism there

would be left nothing worth while, thus destroying the purpose of civilization.

The school board should emulate the example of those in charge of the parochial schools of Chicago and over the United States and teach respect for parental authority and leave to parents the teaching of sexual hygiene to their children in the home.

The whole present-day system of education is wrong. The mill of education grinds, and yet few there be who ask who is doing the grinding. Parents seem to be complacent just as long as their children receive pedagogical training that meets with present-day ideas of efficiency. Too few mothers and fathers really know what is actually being taught their children. They see their reports, sign them and have them returned to the teacher without understanding in any particular their meaning. They are pleased or displeased with the child when it brings its report to them because of the marks which may appear thereon. School teachers in many respects act just as do jailers when they make demands of prisoners under their control. Instead of studying class as well as individual psychology and thus reach a thorough understanding of the needs of each individual pupil, they treat them just as the jailor does offenders of the law by viewing them in the aggregate and treating them as though they were not each possessed of an individual psychology. But little attention is paid to the happiness of the child in its work, and this is essential for the future well-being and civilizing power of the next generation. As Edward Yeomans says in "Shackled Youth" (Atlantic Monthly Press):

> Of course the work of the world has to be done, and it has to be done well. The school standard of craftmanship must be kept high, for the world's professional standard is high. Things must be not only done well in school but done very well. There is no room for sloppiness and tag ends. But that does not involve any lockstep or cast any shadows of the prison house around the growing boy. There is no happiness in anything except a high standard, because there is no happiness in stupidity and awkwardness, but only humiliation and chagrin.
>
> Therefore, we dare to say, having floated so far on our cobwebs, that there is only one kind of person really eligible as an administrator or teacher of a school—namely, an artist; for is not teaching an art? The truth of every subject taught is the emotion and the music at the center of it; and the fact about life is that we miss it all if we miss the joy, and that joy must be of the inward sort, which depends only on its wholesome and well-poised soul and body. And, also, it can safely be stated that 50 per cent of the cultivatable area of children's minds is not touched at all, but goes to waste—like a rainless land.

The three R's of yesterday seemingly have been forgotten by those

who now teach the young. Their brains are beclouded with new theories and isms, with new problems of cramming, that they are trying to evolve to bring to pass the development of the superman. The sooner pedagogs return to the original first principles of education, that of developing beings capable of thoroughly digesting that which they are taught, the greater will be the improvement in the mental caliber of the young.

It must be borne in mind that the school teacher is only human and because of this fact is incapable of acquiring all knowledge.

Yeomans aptly says:

> The test of wisdom is not found in the schools, says Walt, and never will be. But schools ought to start or stimulate a process that will grow into wisdom outside, or into understanding, which, with all our getting, we most need to get; or, at least, into a healthy curiosity for, and sympathy with, the things of the mind and the things of the imagination, past, present, and future. The teacher is he who, passing through the Scholastic Valley of Mara, makes it a well.

For school teachers to be compelled to add, to an already overcrowded curriculum, sex education, is to have too heavy a burden placed upon them—a burden which will sooner or later become onerous.

Sex education, because it has to do with the fundamental basis of life, is too complex a subject to be taught in a schoolroom. No teacher has the time or the patience to train each pupil separately, nor would it be a sensible procedure if he had.

The dangers of teaching sex hygiene in public schools are obvious. If the work is thoroughly done or even slighted, the personal equation of the individual child must be reckoned with. The child is naturally curious and inclined toward experimentation. Therefore the main danger in teaching this subject in public schools is that of possibly arousing the curiosity of the child taught to deliberately try out some of the very things most talked against and thus bring about disaster in its young life.

If the child is taught in the home to respect itself for its own sake and the teaching is thorough, only good can come of it. But before this can be accomplished parents must first receive first hand information on sexual hygiene at the hands of specialists who have spent years of their lives in carefully studying the subject. Parent-teacher organizations should see to it that classes are held weekly for parents in neighborhood school houses, in the various subjects mentioned earlier in this paper. If this is done, it will not be long before school boards now advocating teaching sex hygiene in public schools will abandon their ideas and will leave the matter just where it should be

left, in the hands of parents, who should fully understand the complexities of the minds of their children. I have been writing or speaking on the problems of social hygiene for many years and believe that I have a fair comprehension of the subject. My knowledge has taught me that what I have written is a correct statement of the problems involved and now advocated by Chicago's School Board. I can see nothing but failure in such a project. In ten, fifteen, or twenty years from now it may be possible that there will be enough trained people in the world to properly cope with this most complex problem of teaching sexual hygiene.

THE PROGRESS OF MEDICAL SCIENCE DURING THE WORLD WAR[1]

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SOMEONE has said: "There isn't a great deal of life that is really strange. It's the same old story, and only wonderful to the young." No doubt these words were written by one not in intimate touch with the rushing, roaring stream of life; or, it may be, by one, blasé, pessimistic, some time in the early Victorian era, before the great awakening that characterized the latter half of the nineteenth century had occurred. Be that as it may, who will controvert the statement that today we are living in the wonder age of the world's history? This is a day of many marvelous things, not to the young alone but to the old, time-hardened men and women as well. Recorded history does not reveal any period in which so much that was really strange emerged from the misty unknown for the edification and advancement of the human race as in the present. And it would seem that this is a beginning only, and that the progress thus initiated will, like the Sisyphean stone, once started on its way, sweep with increasing velocity—whither, and with what limitations, and to what purpose? The seemingly impossible is happening constantly. One accomplished wonder but opens the way for the next and greater. The supernatural of seventy-five years ago is the accepted and to be expected reality of today. Doubtless, tomorrow that which we now regard as supernatural will, with increasing knowledge, be the commonplace reality in the physical and natural life, and new ideas of the supernatural will be popularly entertained.. Thus are we speeding toward that day when death itself, "the last great enemy," will be conquered, and that change be regarded no longer as supernatural but just as real and unnoteworthy as the falling asleep at night and the reawakening in the morning light. This is no idle dreaming. It is the inevitable conclusion toward which conscious and thinking man must tend as he views the startling and seemingly impossible developments of the succeeding days.

Do we ever stop a moment to realize, if we can, how rapidly the wheel of progress is revolving? No one here today is aged, and

[1]An address delivered before the Association of Military Surgeons of Illinois on November 20, 1922. Reprinted from the Illinois Medical Journal.

yet within the span of life of the oldest here nearly all that constitutes our modern ideas of comfortable living has been evolved and made commonplace. It was only as recently as 1856 that Morse devised his telegraphic alphabet and by this discovery encircled the globe in a few seconds of time. Marconi, Tesla, Edison and the other wizards of electrical science have followed closely upon his heels, eclipsing his deeds and then their own by wonderful and still more wonderful discoveries—and that sturdy science is still in its early infancy. No doubt some here remember when the first telephones were installed in our cities to the wonder and delight of all; and when elevators, which have made possible the construction of the Woolworth building and other modern sky-scrapers, were first planted in our houses; and I, myself, recall, as a boy, when arc-lights were tried out *for a year* in Philadelphia on "the quiet street of Chestnut"—and I defy anyone to call me old. Today we talk across the continent with comparative ease, and no home would be complete without its telephone and electric service. Wireless telegraphy and telephony are with us now, and interplanetary communication through ether-waves is looming on the scientific horizon.

It was only in 1832, but ninety years ago, that the first railroad in this country was laid between Philadelphia and Germantown, and about the same time steamboats began to ply our rivers and lakes. Today the civilized world is gridironed with steel, and the mammoth coal and oil-burning locomotives and steamships render heavy commercial and passenger transportation but a trifling matter. Truly, the age of steam rose rapidly, only, however, to begin its decline in our day before the strenuous advance of the age of electricity. The same year, 1832, one is amused, when reading of the celebration of the centennial anniversary, in Philadelphia, on February 22, of the birth of Washington, the "Father of his country," to note that the historic tower of Independence Hall "was brilliantly illuminated with glass lamps" which had been loaned by patriotic citizens for that purpose. It was not until the following year that gas-illumination was introduced in Philadelphia; and general electric lighting is a development of but very recent date, within the memory of us all. Now, all the world is ablaze with electricity, and the "great white ways" of our cities amaze and delight.

And thus it has been in every field of scientific activity. Röntgen, delving in the mysteries of the ultra-violet rays of light,

discovered, in 1895, the marvelous X-rays, which defy the opacity of certain tissues and have made it possible for us to look each other through and through—those rays which reached the acme of their usefulness to date during the recent war and compelled the formation of a great and valuable section of the medical department of the world's armies. Organic chemistry took a new lease on life with the discovery of the coal-tar group of derivatives three decades or so ago; and with this increased activity sprang into existence the great number of synthetic compounds which have done so much for medicine and other advanced sciences. Recently the scientific world was all agog over the new theory of relativity propounded by Albert Einstein, of Berlin, whose discoveries regarding gravitation and whose theories concerning time and space, it was claimed, may be as epoch-making as were the discoveries of Copernicus, Kepler and Newton.

After centuries of patient waiting and planning, marked now and then by costly experimentation and the loss of valuable lives, the dream of "Darius Green and his flying machine" became true in our day—as dreams so often do after undergoing the bombardment of biting ridicule and violent opposition—and with the work of Langley and the Wright Brothers aviation came to stay as a long step forward in the problem of transportation. I doubt not that in another decade the air will be vibrant with the roar of transcontinental aerial lines of travel, which will be just as safe and infinitely cleaner than is railway travel today. Truly, in our time has Mother Shipton's prophecy been fulfilled in every detail. Men now ride under rivers and ocean bays and plunge speedily and noisily through mountains and beneath the roar and bustle of the world's greatest metropolis; carriages now move without apparent motive power, and the horse as a means of traction is speedily disappearing from the highways of life, if not from the country byways and lanes. The trolley-car, the automobile, the motor-truck and the tractor, the submarine and the tank have all appeared in the lifetime of the youngest here today. We wonder what would have been the outcome of the great world war had these not been available for the rapid transportation of men and the munitions of war. The 20,000 automobiles of Gallieni's army won the first battle of the Marne and prevented the capture of Paris.

With the explorations of Peary, Amundsen and Scott the hopes of centuries of ambitions and herculean effort were realized, and the poles of the earth today, while not familiar terrain, at least

have been charted, and the coveted laurel of discovery has been won by intrepid men and bold. Who cannot recall the thrill of delight which stirred the very marrow of his bones when first he gazed upon the wonders of the cinematographic screen? It was only in 1894 that Edison patented this fascinating invention. Today it is recognized as one of the best mediums of instruction as well as of mental and physical relaxation at our disposal. Associated with it in our minds is that other brilliant Edisonian invention of an earlier date (1877), the phonograph, which has imprisoned the voice of man and musical sounds upon hard rubber discs and preserved them for all time. This wonder has now largely taken the place of the piano in the average household.

But not alone in the realm of science has this marvelous progress been noted during these recent years. Political and sociological changes, incredible and of far-reaching influence, have occurred the world over. Truly, empires are rocking, thrones are tottering, monarchies crumbling, and royalty fading into the limbo of discarded grandeur. Where now are the Braganzas, the Romanoffs, the Hapsburgs, the Hohenzollerns? Democracy has seized upon the world; the people are coming into their own—when they shall have throttled the red specters of bolshevism that have sprung like the hydra-headed monster of old, out of the turmoil of the war. Portugal, Germany, Austria, Hungary, Poland, Czecho-Slovakia and other smaller republics, people-ruled and people-free, now rise where but yesterday almost absolute monarchism prevailed; and, incidentally, with this democratic governmental evolution the geography of Europe has been rewritten and revised to the perplexity of students of former days.

Twenty-four years ago the sinking of the *Maine* transformed this country from a continental republic into a world power. What changes have since occurred here—changes that rival the wonders of the Arabian Nights' tales! The Caribbean, then a foreign sea, is now an American sea, "the entrance to the great American trade route through the Panama Canal." The Spanish Philippines now have "native rule under an American governor." Then, the "isthmian waterway was a jungle-grown French failure." The Pacific then was a "sea for traders and foreign missionaries"; today "American possessions and naval stations spread across that ocean, flanking the trade routes." Then we were an isolated nation; today we are "asked to make European alliances and join a world league."

Along with these mighty and world-shaking political revolutions old and time-honored ideas and beliefs have fallen never more to rise, and new and astonishing doctrines dominate the masses. Woman suffrage, stimulated by the magnificent work done by the women of the world during the great war, has swept this country, England and other countries of Europe and Asia. At last, after many years of determined effort in the face of ridicule and bitter opposition, the dream of John B. Gough and Francis Murphy has been realized, and now we are face to face with national prohibition. Sociology today proclaims the death of autocratic exploitation of man by man, and the slogan, "Liberty, Fraternity, Equality," is becoming no longer a phrase to be mouthed by orators and demagogues, but a living, burning fact. Time would fail me were I to expand on this age of wonders in the world in all the fields of action and endeavor. What I have thus briefly noted is quite sufficient, I think, to refute the quotation with which I began this address. There is much that is really strange and new in the world today, and "eye hath not seen nor ear heard, neither hath it entered into the heart of man to conceive the things" that are laid up in the rapidly unfolding pages of futurity.

Think not amid these strange, epochal and kaleidoscopic changes that have amazed, and still are amazing mankind, that the great and noble and venerable science of medicine alone has remained dormant and unshaken. In medicine and surgery, as in all other sciences and fields of research, this has been a vital and transitional period of upheaval and overthrow, of iconoclastic scepticism and irreverent profanation. The age-old established views and theories of the fathers of medicine are being subjected to the cold, critical and analytical eye of modern discovery and scientific investigation with startling results. It took two thousand years for men to awaken, but recently, to the truth that malaria is not produced by miasmic poisons emanating from swamp-lands, but that it results from the altogether preventable bite of a certain species of mosquito. It is not taking so long now to overthrow and refute other beliefs of equally sound standing and as honorable lineage as this. Dr. Ira S. Wile, in his paper, "Medicine of Tomorrow," has enunciated a pregnant truth when he asserts that "the era of preventive medicine is at hand." Almost all the advances in medical science of the present century have been along this line.

There is a glamor associated with antiquity. The bright lights in medicine of other days loom larger in the perspective than do

those no less brilliant names of the doers of deeds of our own day and generation. We live too near these to appreciate their true worth; and yet, with the passing of the years they find their proper places and relation to things, and, with the same mirage-like effect, they grow in magnitude and splendor of great achievement. This recent developmental period in medical science, for instance, even now coruscates and is irridescent with glowing names. What shall we say of such immortal lights as Kassabian and Charles Lester Leonard, the X-ray pioneers of Philadelphia; of John Hall Edwards, the eminent radiologist of England; of Clarence Dally, of the Edison laboratory; and of Radiquet, of France, and a host of other brave men and true, who gave their lives in determining the efficacy of the Röntgen rays in medicine? What of Louis Pasteur, "the son of a French tanner, a chemist by education and training, the father of bacteriology, the discoverer of the effective method of combating infectious diseases, he who disproved the idea of spontaneous generation, and laid the scientific basis for Lord Lister's aseptic surgery" (Stockard)? Huxley estimated that the money value of Pasteur's discoveries in anthrax alone saved the world in sheep and oxen enough to cover the whole cost of the war-indemnity paid by France to Germany in 1870; and this to say nothing of his invaluable work on hydrophobia, whose terrors he has practically abolished forevermore. What of Lord Lister, the founder of asepticism and antisepticism in surgery, which have vanquished the gravest enemy of surgical technic and practically abolished some of the greatest terrors of the surgery of the Civil War period? What of Haeckel, the monist; of Huxley, prince of scientists; of Ehrlich; of Gorgas, of yellow fever fame; of Smith and Russell?- What shall we say of Walter Reed, the discoverer of the cause of yellow fever, in whose memory was founded by our Government the great Walter Reed General Hospital in Washington, D. C., where it was my privilege to serve for some months during the recent war? What of Jesse W. Lazear and the other heroic physicians who braved the perils of the plagues of the earth and solved the mysteries of their virulence, but paid with their lives the penalty for their intrepidity? What of Eli Metchnikoff, the Russian zoölogist, who discovered "the phagocytic action of wandering cells in the animal body and investigated the reaction of the organism to disease in the Institut Pasteur" (Stockard)? To him belongs the honor of demonstrating the great battle of the cells forever going on in our living bodies.

What of Fritz Schaudinn, the young German zoölogist, who first stained and demonstrated the specific spirochete (of syphilis) after others had sought it for years in vain; and who investigated the ameba of dysentery and sacrificed himself when but little more than thirty-five years of age in order to facilitate these investigations? Oh, no! The days of heroes and of moral, mental and scientific giants have not yet passed. We have them with us now. They labor among us, often unseen or unnoticed; but they shake the scientific stage with their tremendous accomplishments. It is to their efforts, for instance, that is now due our knowledge of the action of rats, mice, flies, fleas, lice, mosquitoes and other useless vermin, in the transmission and propagation of infectious disorders, as typhus fever, rat-bite fever and the various spirochetal diseases.

On June 7, 1919, the Surgeon General of the United States Army, Major General Merritte W. Ireland, in an address delivered at the Ninety-Fourth Annual Commencement Exercises of the Jefferson Medical College of Philadelphia, enumerated some of the important advances in medicine made during the last two decades. Not by any means is the list complete, but even the non-medical listener here today cannot but be impressed by the notable scientific progress the Surgeon General has compiled. Listen, as I briefly rehearse his tabulation, with some comments and enlargements:

In 1898, Sir Ronald Ross demonstrated incontrovertibly that malarial fever is transmitted by the *Anopheles* mosquito, and thereby doomed forever one of the pests of the tropics and of the warmer portions of our own country. As a result of this discovery and the prophylactic measures which have followed, it is interesting to note that the total number of deaths from malaria in our army during the recent war was but 13. The expected deaths on the basis of the Civil War malarial rate was 13,951, and of the Spanish-American War 11,317. The same year, 1898, Walter Reed, of the United States Army; Victor Vaughan, of Ann Arbor, and Shakespeare, of Philadelphia, proved that typhoid fever may be transmitted by contact and, in a certain percentage of cases, by flies. It was at Chickamauga Park during that year of the Spanish War that the millions of flies spread the fever among the troops with a resulting lamentable mortality. In 1917-1918, owing to the excellent sanitation practiced by Major Abbott in the same park, where over 40,000 troops were encamped, scarcely a fly could be found, and typhoid fever did not exist—and to this I can vouch, for I

was there and saw. Following Reed's discoveries it did not take long for the laboratory scientists to develop the antityphoid vaccine whereby typhoid fever is prevented as effectively as is smallpox by vaccination. In this connection it will be interesting to note some data prepared by Colonel Russell, of our army. Between September 1, 1917, and May 2, 1919, the average number of men in the field was 2,121,396. The total number of deaths from typhoid fever was but 213. Had the typhoid rate of the Civil War prevailed, there would have been 51,133 deaths. Had the rate been that of the Spanish-American War, the number would have been 68,164 (Evans). Everyone knows that it is much more difficult to prevent typhoid fever in an army than it is in civil life because of the unavoidable pollution of the water supplies, the intense congestion of the camps and battle-lines, as well as the inevitable relaxation in sanitary matters among the men. As Evans has said, "so great are these difficulties that never in history have they been satisfactorily overcome, except in this war and in the Russo-Japanese war."

In the opening months of the twentieth century Walter Reed, Carroll, Lazear and Agramonte proved that yellow fever is transmitted by the bite of the *Stegomyia* mosquito, and another fell enemy of mankind was vanquished, soon, we believe, to become an evil memory only. In 1900, Ashford discovered the presence of hookworm infection in Porto Rico; and, in 1902, Stiles described the American parasite of the hookworm infection and traced its curious migration from the toes of those who went barefoot to their lungs and thence to the alimentary canal, where the parasite finds its final lodgment in the body and produces the anemia and consequent laziness and inefficiency of its victims. His findings were still further demonstrated by Loos in 1904. In 1901, Dutton discovered the parasite of sleeping-sickness of the tropics; and, in 1903, Bruce proved that this disease was transmitted by the bite of the tsetse fly—and still another terror of the tropics was vanquished. In 1903, Metchnikoff proved the physiological relationship of the higher primates by inoculating the higher species of apes with the spirochetal (syphilitic) infection—to which all other animals appear to be immune. In 1904, Dutton discovered the parasite of African relapsing fever, and, in 1907, H. G. Novy found the parasite of the American variety; while, in 1905, Schaudinn described the parasite of the great spirochetal disease of mankind (syphilis). This was quickly followed by the famous

discovery of Wassermann in 1906, which Noguchi, the distinguished Japanese investigator of the Rockefeller Institute, modified and improved in 1911. In 1908, Harvey Cushing, of Boston, "produced the condition of infantilism experimentally in the dog, in other words, made an adult dog revert to an infantile condition"—a reversion of one of the greatest processes of nature, which Lord Kelvin, in 1892, declared to be impossible. In 1910, Nicolle demonstrated conclusively that typhus fever is transmitted by the bite of the body-louse, and thereby paved the way for the great, and largely efficient, prophylactic measures that were adopted by the armies of all nations during the World War. Today an energetic campaign is in progress to exterminate this repulsive vermin and thereby and forever another dread pest which has ever devastated the armies of the world. Three thousand British and American soldiers lie buried in Washington Square, Philadelphia, who died from the great typhus fever plague during the British occupation of the Quaker City—victims of this vile pest. In 1910, Flexner, of the Rockefeller Institute, experimentally produced poliomyelitis, the cause of infantile paralysis, that dread of all mothers, and a long step was taken thereby toward the mastering of this disease. The same year, R. G. Harrison grew nerve-fibers in an extra-vital culture, and another mystery of living nature was penetrated by the insatiable curiosity of man. In 1911, Rous proved that sarcoma, a malignant tumor of man and other animals, can be transmitted by a filterable virus—only an additional step in the apparently endless, and, at present unsuccessful, conflict which is being waged by man against malignant disease. The same year Bass cultivated artificially the malarial germ, the plasmodium.

To this compilation may I add Colonel Russell's statistics relative to dysentery in our army during the great war? He found that the total deaths from this disease were 42, as compared with 63,898 for the Civil War and 6,382 for the Spanish-American War. Grouping the findings for typhoid fever, malaria and dysentery, the potential saving of life from these diseases during the late war was 128,754 as compared with the Civil War and 95,595 as compared with the Spanish-American War (Evans). Could words speak more eloquently than these figures, or more effectively as a tribute to medical skill at this time, as well as a notable comment on the marvelous progress in medical science since the days of the Civil War? Such is the incomplete list of great advances made in medical science, which General Ireland has compiled up

to the beginning of the great war. It is a noble record, accomplished without the blare of trumpets or the noisy acclaim of the world—for it is ever so that the heroes of medicine work and achieve.

And then the storm burst. For almost fifty years the war clouds had been gathering; and now, in the fulness of time, in the summer of 1914, the greatest autocratic military power the world had ever seen, inflated with pride and arrogance and swollen with egotism and the inculcated belief in its destiny as a world-saver and instructor, confident that it was composed of supermen—physically, mentally, spiritually—that power, treading ruthlessly upon all the laws of man and internationalism, of morality and decency, and of God Himself, trampled roughshod across Belgium with the nefarious purpose of entering France surreptitiously by the back door—and, incidentally, set the world on fire. At once, all lines of activity, save those of war and of medicine and surgery with their allied sciences, ceased while the nations of the world went about the almost superhuman task of destroying the monster of absolute monarchism.

To him who thoughtfully reviews the progress of medical science during the opening years of this century, as I have briefly noted it thus far, it would appear that much of it was providential in the light of that which followed. Had it not been for the discoveries which had robbed malaria, typhoid fever, lockjaw, dysentery, yellow fever, hookworm infection, and the specific diseases of mankind of much of their terrors one would stand appalled and aghast at the mere thought of what might have happened to the millions of soldiers of all lands, to say nothing of the famished and unsanitary populations of the war-ridden countries of Europe and Asia. As it proved, the work of these heroes of medicine and surgery found its supreme testing on the field of battle and in the hospitals back of the fighting line, and did not fail. Upon the substantial basis thus provided the medical corps of the world shouldered their herculean tasks and made good to the credit and honor of the profession and to the general welfare of the peoples of the world. Glancing cursorily over the medical and surgical advances of five years (1914-1919), some salient and suggestive facts will be noted.

From the standpoint of the pathological laboratory, probably the most remarkable and startling development of the war was the widespread destructive action of the blood-dissolving strep-

tococcus (*Streptococcus haemoliticus*), which was responsible for most of the deaths resulting from pneumonia during and following the dreadful epidemics of measles and influenza. And as yet, I regret to say, no serum or vaccine or antitoxin has been devised to successfully combat the pernicious action of this most virulent germ. We all realize, of course—as who does not—the gravity of that terrible pandemic of influenza that swept irresistibly over the land from the navy yard at Boston harbor, where it started on August 28, 1918, until it reached the coast-line of the Pacific, carrying away in its devastating progress nearly 500,000 of our population; that same scourge which in its passage around the world in less than a year's span, swept six million souls into eternity; but do we realize that the epidemic of 1918 was the worst influenza epidemic in history, as Vaughn and Palmer[2] have noted? And this notwithstanding that "in the last 800 years there have been 28 pandemics, or world epidemics, and about 72 additional widespread and fairly distinct waves of the disease." More than one-third of the entire population of this country contracted the disease that year, and of those attacked, as I have already mentioned, nearly half a million perished. Vaughan and Palmer, writing on communicable diseases in the United States Army, say that "the plague epidemic of 1665 in London killed 14 per cent of the total population. The yellow fever epidemic of Philadelphia in 1793 killed 10 per cent of the population. Third in severity was the influenza epidemic in 1918 at Camp Sherman, where 3.1 per cent of the entire population died in seven weeks from influenza and pneumonia. In the combined United States Army camps during four months 1.5 per cent of the population died." This outbreak stands fifth in rank in Vaughan and Palmer's list of deadly epidemics; but, as Evans has indicated, "none were listed by these investigators except epidemics in the better known parts of the world—regions where statistics are somewhat reliable and obtainable. The ranking would have been different had epidemics among the less civilized peoples been taken into account." In Philadelphia, the worst hit city in the country, the epidemic destroyed .77 per cent of the entire population in seven weeks; in New York, .39 per cent. The figures for the entire country are generally given as .45 per cent. The fatality rates were more than three times as high as in the epidemics of 1890 and 1891. Various

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[2]Vaughan and Palmer, *Journal* of Laboratory and Clinical Medicine, July, 1919.

statisticians are agreed that more people died from influenza-pneumonia in 1918-1919 than died from the same disease in all four of the years between 1890-1894 (Evans). About 84 per cent of all the deaths from disease in the United States Army between September, 1917, and May, 1919, were due to influenza-pneumonia-bronchitis (Evans).

This most virulent form of pneumonia, in which the patients seemed to literally drown in their own serum, was, probably, the most terrible pathologic feature of the war period. It was noted particularly during the great influenza epidemic of 1918 and after the measles epidemic in the Army in 1917-1918. It is interesting to note, in this connection, what Vaughan and Palmer record as to contagious diseases in the Army. They state that measles was 19 times as prevalent in our training camps as in civilian life, and that pneumonias were 12 times as prevalent in the camps as in the civilian population. Meningitis was 45 times more prevalent in the camps than in the civilian population; scarlet fever six times as prevalent; and diphtheria twice as prevalent; while typhoid fever and its allied diseases, including dysentery, were negligible. Tuberculosis, on the contrary, was 13 times more prevalent among civilians than among soldiers. This was due mainly to the elimination of tuberculosis in the examination of the drafted men, coupled with the healthy outdoor life which the soldiers are compelled perforce to live. Here we have a virile argument in favor of universal military training.

So far as is known, the great war developed but two entirely new diseases. *Trench fever* first appeared among the English troops shortly after their entrance into Flanders. While not a fatal disease, it became so prevalent that it incapacitated a large percentage of the men, and, therefore, became a serious menace to the Army. It was not until our own Research Committee, headed by Major Richard P. Strong, of our Army Medical Corps, in December, 1917, began an experimental investigation of this disease that its causation and pathology became known. This committee ascertained beyond doubt that trench fever is a specific, infectious disease transmitted by the bite of the body-louse. This was an important finding, for the disease was causing a tremendous loss of man-power not only in the British army but in all armies engaged in the war. At once an active campaign was instituted for the destruction of vermin, and by the time of the armistice the results of this prophylaxis were beginning to be felt Today

energetic steps are being taken the civilized world over to destroy vermin of all kinds, including rats, mice and lice.

Lethargic encephalitis, popularly known as the "sleeping sickness," first appeared, according to Flexner,[3] in Vienna and neighboring parts of Austria in the winter of 1916, and in the United States in the winter of 1918-1919. It is a disease affecting especially the gray matter at the base of the brain and the tissues of the spinal cord. It may produce paralysis of the ocular, facial and other muscles. It occurs with extreme abruptness and shortly presents the most characteristic symptom—marked lethargy or drowsiness—which is progressive in character and present in about 80 per cent of the cases. This stupor may persist for a few days only, or it may last for months. In patients who recover, the return to clear mentality is, as a rule, gradual. The disease occurs at all ages and is about equally common in both sexes. It has a high mortality (20 to 40 per cent). It is most prevalent in the winter season. It is undoubtedly infectious in nature, probably through the secretions of the nose and throat, but nothing whatever is known as yet as to its exact causation.

While it is true that these two diseases comprise the only new pathological entities which developed during the war, there was much that made for real progress in all the various branches of medical and surgical science during that period. Time would fail me were I to speak in full of the advance made in the management of shell-shock, a condition which we now know is nothing more nor less than a manifestation of grave hysteria and a sign of a depraved nervous system; of the wonderful results following the paraffine treatment of burns; of the development of the therapeutic management of gassed patients; of the excellent clinical results obtained after nerve-splicing and nerve-transplantation for the relief of traumatic paralysis; of the advance made in our knowledge and management of surgical shock; of the new uses for physical methods of colored lights; and of the marvelous development of the X-rays in as far as their practical application is concerned. One great lesson was learned by all who had the privilege of active service in the armies of the world, namely, that war surgery differs in no respect from ordinary civil survery in as far as the general principles of technique and of asepsis and antisepsis are concerned. Only in the multiplicity of the wounds en-

[3]Simon Flexner, *Jour. Am. Med. Assoc.*, Vol. 74, No. 13, March 27, 1920.

countered and in their unusual sites and characteristics is a difference to be noted. Thanks to the labors of Dakin in the chemical laboratory and to the practical application, by Carrel, of the Dakin fluid to poisoned and unclean wounds of all kinds, an astonishing amelioration of septically infected wounds was noted. With the proper Carrel-Dakin technique aided by the trolley-system of suspending the affected limbs, pain, suppuration and swelling fled as if by magic; and in a few hours after the institution of the method, those who had been rolling and groaning in agony had their wan and pallid faces wreathed in smiles of wonder and gratification. It was my great privilege to see and use this method at the Rockefeller Institute of New York City and in the septic wards of the Walter Reed General Hospital at Washington, D. C.

This advance in the treatment of sepsis is, as Armstrong[4] has indicated, but one instance among many of the manner in which "the war has brought into closer daily association the surgeon and the scientific workers in the scientific departments closely allied with practical medicine and surgery. Chemists, physiologists, bacteriologists, biologists and pathologists have been brought into intimate association with the problems of the bedside. Many have for a long time felt that in our medical schools and hospitals there has been too great a dissociation between the primaries and finals, between the workers and teachers in the scientific and practical subjects. It must always be remembered that the medical work of the war has been performed by the medical profession, and after the war they will doff their military dress and resume civilian practice enriched by their varied experiences. The lessons learned during the war will be applied after the war." Armstrong believes that one of the most important and far-reaching results of the war will be a change in the methods of medical education. What the more immediate changes may be it is difficult to predict, but that both undergraduate and graduate studies will be differentiated more in the future than in the past is highly probable. "The same factory cannot turn out Ford and Rolls-Royce cars, nor can the same school turn out general practitioners, physiologists, biologists, and chemists with economy of time to all. The undergraduate teaching best adapted to one intending to devote his life to preventive medicine is not necessarily the best education for the man preparing for curative medicine."

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[4]Armstrong, *The Canadian Association Medical Journal*, 1919.

I think you will agree with me that this résumé would not be complete without a brief reference to the reconstruction department of the United States Army. According to Dr. Frank Billings,[5] the policy of physical and mental rehabilitation of disabled soldiers, sailors and marines was formulated in the office of the surgeon-general of the Army in August, 1917; was applied in seven hospitals early in 1918; and, finally, was approved by the War Department on July 29, 1918. The object of this department is the restoration of these physically and mentally incapable men to as perfect a condition as possible. The work is defined as "continued treatment, carried to the fullest degree of maximum physical and functional restoration consistent with the nature of the disability." To this end all known measures of modern medical and surgical management have been applied, including mechanotherapy, electrotherapy, massage, reconstructive wound-healing, mental occupation for the cure of shell-shock, and the teaching of various arts and trades to the disabled soldiers. The educational program embraces courses in technical, agricultural and commercial subjects. Says Dr. Billings:

Many disabled soldiers who were qualified aided in the training of their fellow patients. Civilian women worked as reconstruction aides in giving courses in the arts and crafts and commercial studies. A director of sports, games, gymnastics and military drill supervised these branches in cooperation with the American Red Cross, Young Men's Christian Association, Knights of Columbus, Jewish Welfare Board and Salvation Army. Special buildings, gardens and fields have been utilized for the purpose of training convalescents in workshop and academic courses and in agricultural pursuits. Equipment for shops, schools, physiotherapy and gymnasiums has been supplied. Needful books have been furnished by the American Library Association.

At the height of this work forty-seven reconstruction hospitals were functioning. This number was later reduced to forty-four general and base hospitals in which the work was carried on, and this number was gradually reduced as the number of patients diminished. After July 1, 1919, the work was concentrated in nineteen hospitals, and today there are only a few of these in active operation. After the signing of the armistice, convalescent camps were established in various parts of the country, where the soldiers received the final hardening and curative processes by means of setting-up exercises and military drill. Necessarily, this course of

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[5]Billings, *Jour. Am. Med. Assoc.*, July 12, 1919.

treatment involved, in many instances, a prolonged retention of the soldiers, who naturally chafed under the restriction and longed to return to their homes. One can sympathize, therefore, with the colored soldier who accosted a Red Cross visitor in one of these Army Reconstruction hospitals with the query: "Say, boss, what is they keepin' me in this yere hospital fer—a souvenir?"

The results of this unique move in the history of war medicine have been gratifying to the utmost. Dr. Billings states that "in spite of almost insurmountable difficulties it is believed that physical reconstruction of the soldiers has been of the greatest value in maintaining discipline; in the promotion of morale; in the diversion of the soldier's mind from his disability; in the arousing of his interest in education which would overcome his handicap; and in securing a physical and functional restoration of power. Often the patients have been enabled to take up a more lucrative profession than that which they held formerly, and the men have been stimulated to take further training with the Federal Vocational Board after discharge from the Army."

Such, briefly, is a résumé, necessarily fragmentary and incomplete, of medical and surgical progress during the period of the World War. Enough has been mentioned, however, to prove that the medical profession has not lain dormant during these cataclysmic years, but has nobly upheld all its traditions and has been alert and active, cooperating with its sister sciences for the welfare of the race. It is too early as yet to fully realize the value of the progress that has been made, but that it has not been inconsiderable and negligible even a cursory glance will convince.

And now, ere I close, may I be permitted to dream for a moment? We are at the conclusion of the greatest war that history has ever recorded. The smoke and grime have not yet cleared away. Nations are still fighting and others are quarreling. The earth still shakes and the air rumbles with the sullen roar of the iron-throated voice of Mars. But man is tired of it all and is turning longing eyes toward the quietness of that time when there shall be "peace on earth, and good will toward men." Is history about to repeat itself? Are we on the eve of a great literary recrudescence such as that which followed the war-storms that convulsed Europe in the early portion of the sixteenth century? From that bloody turmoil emerged the glorious Elizabethan period of literature marked by famous names—Spencer, Shakespeare and the rest. And out of the crash and slaughter of the

Napoleonic wars sprang the still greater literary period—the Victorian era of wonderful and inspiring literature, which, save for a few rare volumes and still rarer incunabula, practically comprises the libraries, public and private, of today. This era, as we know, gave way to the mechanical and scientific period which persisted up to the breaking out of the war and was characterized by a notable dearth of good literature. Now, as the smoke and din and havoc of this last great Teutonic eruption—the greatest and most formidable of them all—are sullenly dying away in the narrowing vista of the past, will a new, and it may be even greater, literary period slowly arise from the ashes, the phoenix of a happier day for all mankind? Who can say? This we know—that it has ever been so. It seems to be the natural reaction from disorder, convulsion, pillage and death to the peace and quiet of the library and the fireside.

DIPHTHERIA[1]

By Professor CARL SCHLAYER, Berlin

THE EXPERIENCE regarding diphtheria during the war appears to be of some interest because it is the first great campaign in which the value of modern diagnosis, modern methods of treatment and modern theories concerning the spread of diphtheria have been given a fair trail.

In 1870 and previous campaigns the statistics were naturally primitive and insufficient; only the unmistakable, clinically diagnosed cases were counted as diphtheria. In the sanitary report of 1870–71, covering the period from July 16, 1870, to the end of June, 1871, only 174 cases were given, which equals 2.2 per 10,000 (out of an average of 788,213 men). The mortality was high, namely, 24, or about 14 per cent.

It might be expected that the statistics of the wars during the last few decades would show the results of the advances made in the diagnosis and treatment during the interim. Nevertheless, there were no other statistics to be found except those of the Japanese-Chinese War of 1894, and these give the number of diphtheria cases as only two. Our colonial wars give no further information concerning the number of diphtheria cases. The sanitary report of 1902 mentions for north China only the average in per thousands of all the diseases and gives the number as 0.35. But the conditions in China in 1902 were not to be compared with a campaign.

The statistics for the African campaign have not appeared yet. The results of the statistics of the four years of war, 1914 to 1918, are therefore of great interest. They include the period from August, 1914, to March, 1918. The first year of the war is to be understood to consist of the period from August, 1914, to August, 1915, etc. The first months of 1918 (March to August) have not been compiled as yet. The figures include only the German troops and not the enemy prisoners in Germany.

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[1] Due to the incompleteness of available literature, it will be impossible to treat in detail all the important sides of the subject in this paper. Those sections in which sufficient material is at hand, or in which something new has developed, will be treated rather minutely. It will, therefore, be found that clinical experiences will predominate, particularly those I have gathered myself. Especially are bacteriological questions, in so far as they do not directly concern the clinician, only given a secondary consideration if they are mentioned at all. Translated from Handbuche der Arztlichen Erfahrungen im Weltkriege, Vol. III, Innere Medizin, by Capt. A. T. Gilhus, M. C., U. S. Army, by permission of Dr. Ludolf von Krehl and Herr J. A. Barth.

Admissions for Diphtheria among German Field Troops for the Four Years of War, According to Hospital Sick Reports

From August to August, year of war	*Number of sick*	*Per 1,000 of strength*	*Number of deaths*	*Per cent of afflicted*
First year of the war......	1,382	0.54	55	4
Second year of the war....	5,806	1.4	170	3
Third year of the war.....	7,233	1.5	168	2.3
August 17 to March 18....	7,441	1.5	86	1.2

Admissions for Diphtheria among German Garrison Troops for the Four Years of War, According to Hospital Sick Reports

From August to August, year of war	*Number of sick*	*Per 1,000 of strength*	*Number of deaths*	*Per cent of afflicted*
First year of the war......	3,179	1.65	104	3.2
Second year of the war....	8,410	3.3	161	2
Third year of the war.....	6,773	3.1	155	2.3
August 17 to March 18....	8,099	3.9	115	1.4

The figures are next briefly compared with those of the civilian population before the war, as no statistics were given out for the civilian population during the war. During 1912, 77,420 cases were reported to the German authorities for the entire state of Germany. This gives a rate of 11.6 per 1,000, on the basis of a population of 67,000,000. The admissions per 1,000 among the field and garrison troops varied from 0.54 to 3.9. Of course only men are taken into consideration in the latter figures—men between the ages of twenty to fifty years. No figures exist concerning the number of cases of the disease, only the number of fatal cases. During the year 1912 only 100 men between the ages of twenty and fifty died within the German Empire, which is equivalent to 0.15 for each 100,000 inhabitants. These astonishingly low figures perhaps do not include all men who really died with diphtheria. In comparison the combined army (field and garrison) figures are relatively high as they vary between 3.7 and 4.4 per 100,000. A general survey of the civilian population of all ages and of both sexes, according to the medical statistical reports of the board of health, show an occurrence of diphtheria varying between 24 in 1900 and 18 in 1913 per 100,000 population.

The statistics of the army in peace times present similar conditions with regard to diphtheria. According to these there was an occurrence of diphtheria in the entire German army varying between 1.5 per 1,000 in 1911–1912 to 0.51 in 1901. These figures were exceeded by the garrison troops during the war, but remained remarkably close to them in the field army (1.5 to 0.54 per 1,000).

The mortality of the entire German army in peace times averaged

between 1.5 to 4.9 per 1,000 since 1900. During the war the mortality reached only once 4 per cent and averaged 2.5 per cent for the garrison and field armies. It was therefore by no means higher than the peace-time figures, which is worthy of note.

If the morbidity and mortality figures are compared for the different years of the war, we make two discoveries: that the morbidity figures show a strong tendency to rise in both garrison and field armies during the war, particularly during the last year. Although our figures embrace only eight months during this period, they contain quite as many as the previous entire years.

It appears questionable whether the reason for this increase is due to a genuine increase in the occurrences of the disease. It would seem more probable that the improved diagnostic methods (increase in the number of and the improvement in the laboratories, improvement in the sanitary precautions, etc.) tended to increase the number of cases discovered. The decreased mortality figures of the war add additional weight to this supposition.

The percentage of fatal cases gradually decreased in both the garrison and field armies during the four years of the war, reaching the highest point in the first year and the lowest point in the fourth year of the war. This was probably due to the improvement in the medical and sanitary organizations incident to the gradually developing trench war, etc., which tended to bring the cases to the doctor's notice more quickly, making an earlier diagnosis possible and thereby favoring earlier treatment. These same factors also caused a larger number of milder cases to be identified as diphtherias, whereby the number of these cases increased but the mortality decreased.

From an epidemiological point of view the statistics give food for further deductions. They prove that diphtheria does not belong to the class of diseases which exhibit a noticeable increase in frequency during conditions incident to war, such as typhoid and dysentery do; it should, therefore, not be classed among the war diseases. With the exception of the period covering the last eight months the war diphtheria figures approximate, surprisingly, as previously, mentioned, those usually encountered during peace conditions—this in spite of the influences which must favor the spread of diphtheria among the troops in garrison as well as in the field. It might reasonably be expected that the number of cases would materially increase because of the hardships incident to unfavorable weather conditions, living together in close quarters under the most primitive conditions, dirt and uncleanliness, use of the same eating utensils, etc. On the contrary, however, the field troops, which were particularly subjected to all these unfavorable conditions, show,

at least according to our figures, a decidedly lower admission rate than the garrisoned troops. This does tally with the experiences gained in the larger cities, in which overcrowding and faulty sanitary measures is of great importance in the spread of diphtheria. The reason for this difference is, in my opinion, to be found in the difference in the class of people: in one case it is a question of men only, men between the ages of eighteen to forty-five or fifty; the other consists of people of all ages, particularly children. Evidently grown men do not furnish suitable nutrition material for the growth of the diphtheria, while the civilian statistics show that children offer the most favorable conditions for its growth. That probably also accounts for the greater prevalence of the disease among the garrisoned troops, who were in closer contact with the civilian population, particularly the children. My personal experience adds further weight to this theory: the majority of my soldier patients and carriers, whom I treated in their own homes, had children who were afflicted with diphtheria. Likewise experience taught that in the majority of the epidemics occurring among the soldiers in the field the cause could be traced to the return from furlough of a carrier in whose home the disease was present. It remained, however, always a surprise that the favorable conditions for the spread of the disease exerted such a slight influence on the morbidity.

There are but meager reports available concerning the extent of the epidemics. Epidemics involving nearly 100 cases appear to have occurred; the largest (98 cases) seems to have taken place in the 19th R. D. in December, 1916. A second one of 13 cases broke out in the same organization February, 1918. The field recruit depot of the Kowel section had one during December and January, 1916–17, involving 46 cases; the pioneer field recruit depot No. 5 had 53 cases of diphtheria January, 1918. Finally an epidemic, involving 88 cases is mentioned, which took place between November 5, 1916, and May 30, 1917, in the 213th I. D., and a smaller one in the cadet barracks at Karlsruhe in January, 1916. It is worthy of note that all these greater epidemics took place during the months of January and February and involved mostly recruit depots, and that thorough investigations revealed the fact that the causes were traced to outside homes. With regard to other periods of the year the war figures tally accurately with those of civilian origin (see the monthly curve in Schulz's "School and Diphtheria," Diseases of Children, Yearbook for Treatment of Children, Volume 16). It would indicate that the state of the atmosphere is not without importance, but otherwise it has exerted no influence on the collective morbidity.

Concerning the clinic of diphtheria the available reports hardly add

anything new of importance. From personal experience in field and homes may be mentioned that the majority of my cases gave an impression of very mild attacks; they did not give the picture of a frank throat diphtheria, but rather one of "angina lacularis." As the clinical course also indicated rather an angina the bacteriological findings of diphtheria came often as a surprise. The characteristic odor of the disease, which Dorner has resurrected, was many times an aid in the diagnosis but also failed often. Many cases ran their course without even these symptoms; at times, in isolated commands, numerous cases occurred in which only a catarrhal angina was found, but which was accompanied by positive microscopical findings. This same experience was also reported from the second epidemic of the recruit depot No. 19, R. D., in 1918. In the majority of these cases there were only reddening and slight swelling of the tonsils, without membrane and without particular elevation of the temperature. Rolly made similar observations during the Leipzig epidemic in 1916. The clinician has repeatedly tried to attribute to the diphtheria bacillus a more accidental, secondary rôle in these cases and refer to them as angina lacularis with diphtheria bacilli in preference to diphtheritic angina. Quite a number of physicians appear to have adopted this point of view. That such an angina acularis or catarrhal diphtheria is accompanied by the sequela of a genuine clinical diphtheritic angina, such as polyneuritis, heart disturbances, etc., is well known, and it is self-evident that they are of the greatest importance from an epidemiological standpoint. The studies of the formation of antitoxin in the blood is very desirable at the same time. In my personal experience the "Rezidive" (convalescence?) from diphtheria very frequently took place within a short time (two to five weeks), and in the meantime the bacilli disappear, as demonstrated by the usual three examinations.

In one particular instance, a case of angina developed fourteen days after a typical clinical and bacteriological diphtheritic angina which had received an injection of 4,000 units. It was accompanied by a high temperature and a grayish-white follicular membrane containing diphtheria bacilli. However, the bacteria had not disappeared from the throat during the interval between the two sicknesses. The possibility therefore exists that a common angina had developed in a diphtheria carrier. The appearance of the membrane indicated diphtheria.

According to reports, cases are also observed in which the evidences of the presence of diphtheria bacilli are present and which developed new typical signs of the disease after a long dormant period.

Inflammations of the kidneys must be a relative frequent complica-

tion of the disease; they were frequently present in severe degree in my cases; heart complications, however, do not appear to be have been common.

Neither my own experience nor that reported by others, adds anything new to the treatment. The results of intravenous serum therapy (F. Mayer) in large doses, in severe cases, are of interest, and used with good results by V. Strumpel. It is also of importance to know if anaphylaxis symptoms occurred oftener in the severe forms. Personally, I have never seen them in diphtheria; neither has Leschke. Schwenkenbecker found serum disturbances in 6.5 per cent of his cases; he considers the variety of animal serum, with regard to danger from anaphylaxis, as of minor importance.

Serog describes a cerebellar ataxia as a sequel to diphtheria.

Wound diphtheria will not be discussed in this paper.

Diphtheria of the nose deserves mention, particularly the chronic form (Neisser). In the reports we find but little concerning it, and it appears as if examination of the nose for diphtheria carriers has not been done very often. But they are probably not of rare occurrence, because I found among 300 patients suffering with war kidney disease no fewer than six chronic nose diphtheria carriers. All of these cases had dry, chronic, atrophic rhinitis without other symptoms (like Wittmaack's cases). Only the characteristic odor of diphtheria from the nostrils aroused suspicion, which was confirmed by bacteriological examination. However, the throat findings were not always likewise positive, as supposed by Wittmaack. Klages has made similar observations.

The available reports do not give anything new with regard to the spread of diphtheria, nor change our previous conceptions concerning it. According to our theories it is the sick human who is the source of the diphtheria. From him they are distributed either through the agency of a carrier, who, without himself becoming sick, picks up the bacillus from the vicinity of the sick, or it may be the patient himself who remains a carrier after the cessation of the disease. As already mentioned, the reports state that the larger epidemics had their origin from carriers, who had recently returned from infected homes. Two interesting cases are cited: On the 29th of January, 1918, two recruits, A and B, joined the 19th I. D. recruit depot. They had each two negative smears for diphtheria (the reason why they were examined is not evident). On the 14th of February a bunkie of A's took sick with suspicious symptoms. The examination of the men, who were quartered together, showed that one additional of these men was a diphtheria

carrier. Simultaneously a delayed report arrived from the depot stating that A and B both had developed a positive smear in the third swab which was taken before their departure. Thereupon eight more bunkies of A and B were examined, and of these three more were found to be carriers without exhibiting symptoms of sickness. Thus, within a period of fourteen days, the two original carriers had infected no fewer than half of their eight comrades. In spite of immediate isolation a small epidemic developed in this company, with ten sick and nineteen carriers.

Cases of diphtheria developed frequently in the 74th Regiment of Infantry of the 213th I. D. sometimes with long intervals. The regiment received its recruits mostly from Osnabruck and Hanover, where diphtheria is supposed to be endemic. Therefore an examination was ordered by the division surgeon for carriers among the new recruits, with the result that no fewer than eleven carriers were found in a short time. The disease appears to have been stamped out after that.

Of great importance in the understanding of the spread of diphtheria is one theory that has not been sufficiently emphasized in the older literature: the relation of the bacillus carrier, without disease symptoms, to those sick with the disease was always very high in all the epidemics according to the reports received. Thus there were 62 carriers in the epidemic, previously mentioned, consisting of 95 cases, which occurred in field recruit depot No. 19, I. D., during the winter of 1916. In the second epidemic, in the same depot in the spring of 1918, there were only 13 patients as compared with 39 carriers; in the one at Brest-Litowsk, the field recruit depot of the Kowel section, there were 18 sick and 32 carriers; lastly, in the Karlsruhe cadet house in January and February, 1916, there were 14 patients with the disease as against 30 carriers. The carriers therefore consisted of twice, or more, the number of the afflicted. The explanation of these high figures undoubtedly lies in the fact that the examination of the territory, under military conditions, could be done more thoroughly. It is of course impossible to judge from the reports whether technical conditions did not also have something to do with it; but the frequency with which these high numbers of carrier figures are found indicates that it is a characteristic of diphtheria and one which deserves particular attention in the fight against the disease.

Corresponding to these experiences, the question of what influence favors the resistance of powers of the diphtheria bacillus becomes of importance. The experiments of Wittmaack on forty healthy carriers is of interest in this connection. Of these we learn that chronic changes

in the upper respiratory tract favor the retention of the bacilli and add to the difficulty of their removal. The tonsils appear to take an important part in the make-up of a carrier. According to new anatomical and experimental studies it is a lymph gland in which all foreign body materials, etc., are retained and gathered in the throat. It appears, further, to be an excretory organ, which again gradually and slowly excretes the retained substances on its surface. The essentials for the creation of a carrier are, then, according to Wittmaack's theories, a comparatively mild, acute inflammatory change in the nasopharynx, which makes possible the reception of the bacteria from the air passages. From there they are gradually carried to the tonsil, where they are stored to again be slowly expelled from its surface. Hereby is an important but disagreeable experience explained—the intermittency of the diphtheria bacillus excretions which, according to some observers, may take place for weeks, and that they may be the cause of entire epidemics (see above, epidemic of the 19th I. D., 1918).

The average duration of the bacilli excretions amounted to four to five weeks in Wittmaack's cases, which is corroborated by the figures presented by Scheller, Jockmann et al. Ninety per cent of Küster's carriers required the same period of time. It should, however, in the large majority of cases take shorter time, at least according to the figures of Prip, Schiller and Neisser; they found bacilli present thirty days after the beginning of the sickness in 8, 18 and 17.5 per cent of their cases respectively. Klages found, after thirty days, 61 per cent positives out of 516 cultures from nose and throat, which were particularly carefully performed, which shows that the bacilli may persist in the nose alone for a long time. That also answers the further question as to how many of the diphtheria convalescents may act as carriers. I can't find satisfactory information concerning this in the available literature.

The assertion in the Kolle-Hetsch textbook, that the bacilli do not persist so long in the carrier as in the convalescent, is probably true in general but not always. I saw the most persistent presence of the germ in two carriers, who had never had the disease, but whose wife and child, respectively, had had diphtheria. One of the most important points in the understanding of the methods of the spreading of diphtheria, and also in the methods of fighting it, is the danger of the carriers to their surroundings. Kruse is of opinion that the healthy bacilli carrier is but slightly capable of infection.

In opposition to this view are numerous reports in which the full virulence is attributed to the persisting bacilli. A series of clinical experiences, which appear to show that healthy carriers were the cause

of epidemics is also presented. The above cited information confirms this theory. One must, however, admit that the spread of the disease was relatively limited considering the large number of carriers in the epidemics previously mentioned. It is safe to assume that the gradual auto-immunization, incident to intercourse with carriers, is of importance, as asserted lately in a series of reports. That the carrier is also of danger to himself would be indicated from the observations of Dorner, in which a carrier wound up a case of measles by developing a laryngeal diphtheria.

The prophylaxis against diphtheria followed the standard measures, in which particular attention is paid to the prevention of the spread of the infection from man to man. Consequently, in every epidemic, all contacts were isolated and examined to determine if they were carriers. Proven carriers, without exception, were taken to the hospital. In addition to the customary disinfection of the quarters, these precautions seem to have been sufficient to quench the epidemics. In some isolated instances prophylactic immunizations of the neighborhood were also performed as, for example, in the field recruit depot No. 19, R. D., in 1918. This valuable aid in the fight against the disease was, however, frequently declined on account of fear of the anaphylactic complications, in spite of the urgent advice of the field sanitary chief to have it performed. Behring's defense remedy, "T. A." (toxin-antitoxins), was thought of but seldom used because the field sanitary chief decreed that "sufficiently active protective remedies are at disposal in the thorough examination for germ carriers and in passive immunization."

One of the most important problems in this connection was the cure of the carrier. ("Here the war was a strong stimulant outweighing in quantitative less so in qualitative respect.") Our knowledge of the causative factors of why a person becomes a carrier has not been added to, with the exception of Wittmaack's work; and as long as this knowledge is so incomplete all new remedies must be considered. No matter how strongly a remedy restricts the action of the diphtheria bacteria in the test tube, if we do not find their strongholds and put an end to their further production, our method of treatment remains a superficial treatment. Wittmaack's above-mentioned observations will perhaps give the impulse for a different attack of the problem. He considers local applications of secondary importance to an attempt to obtain influences from the blood or lymph organs.

A number of chemical and physiological remedies have been suggested. It is naturally difficult to give the results obtained, due to the fact that the majority of the carriers would have become free from

the germ in a period of from four to five weeks independently of treatment. The majority of the reports do not take this circumstance into consideration. It was considered sufficient for the proof of the efficiency of a remedy when it performed the work on a series of particularly stubborn cases without too numerous applications. The reports do not, therefore, render any final decision, at least not in the positive, but perhaps in a negative sense.

Iodine was used most often, either in the form of the tincture alone or after a preliminary application of some remedy like ammonium carbonate to remove the mucus. A mixture of some iodine preparation (KI 5 per cent and a few drops of HCl) was often tried with a H_2O_2 gargle in order that the free iodine might work on the mucous membranes in its nascent state. The reports show how different were the results obtained. The military surgeon of Brussels reports lasting good results; he claims permanent cure in eight to ten days of 25 carriers. The military hospital at Origny likewise reports good results; 13 carriers were cured in a few days. But in the military hospital at St. Michel 18 per cent of forty-four carriers were not cured. In all these cases the period that these persons had been carriers is not given.

The Belgian sanitary inspector Lomry suggests a 4 per cent watery or glycerine-iodine-potassium iodide solution (stock solution: iodine 10, KI 15, aq. dest. 100) or a "more potent one" of 4 c.c. of the stock solution to 100 c.c. sheep blood serum, freshly mixed, and slowly injected into each nostril and the throat, twice daily, with a long necked syringe in doses of 20 to 25 c.c. The bacilli are supposed to have disappeared in five to six days. But the reports vary regarding this remedy also: sanitary jurisdiction 2 S. A.-K. reports two cases where the germ reappeared. In two 3-week-old carriers I saw the bacilli disappear, likewise in a case which was not very carefully described by Otfried Müller of Tübingen. Military Surgeon Brüssel reported the cure of twenty-one carriers (duration of carrier period not given) after three to four applications; one exceptionally long-drawn-out case lasted twenty-three days. Complaints and pain, however, always accompanied the treatments. But on the whole it appeared to be more effective than the plain iodine swab, even if later it did fail me in some obstinate cases.

Of the other recommended remedies only the new ones will be mentioned; the older ones are fully described in Küsler's compilation.

Providoform (tribrom-betanaphtol), by simple swabbing, lauded by Leschke, has produced no results in the 2nd Army Hospital. Justitz obtained excellent results in sixteen carriers, among them one stubborn case, by swabbing with oxycyanate of mercury 1:4,000. W. Pfeiffer reports to have treated the most obstinate cases with eukupin. He

succeeded in obtaining freedom from bacilli in the majority of cases, sometimes treating the chronic nose and throat disturbances at the same time. His method of treatment consists in swabbing with a 1 to 2 per cent solution of eukupin, atomizing with a weaker solution (0.1 to .03:10), etc. Kleinschmidt observed, however, no decided results following its use in children. I have used it in the form of a throat swab in a 2 per cent solution in some obstinate cases which had resisted other methods of treatment for long periods with fairly rapid results, but I have also had many failures. If applied too frequently, eukupin may product superficial blisters. With regards to yatren (para-iodo-theo-sulpho-zyclo-hexa-trien-pyradin), Bischoff and Kausch, as well as with the malon acid, recommended by Conradi, we have no extended experience so far as I know.

Rolly has given an interesting method; he tries to obtain an acute inflammation of the throat by the use of ultra-violet rays from the sun and hopes to kill the bacteria in the same manner in which they are destroyed in the bowels by the same means. I observed the bacilli disappear in a number of less obstinate cases treated by Rolly's method, but as eukupin was used simultaneously, the observation is of no value. W. Pfeiffer claims to have had no success with Rolly's method. Wittmaack has not obtained any decided results in the use of local application of diphtheria serac in the dry form nor with the local injections of the serum, which are recommended by so many; his results have likewise been negative in the formerly often pardonably used subcutaneous or intramuscular serum injections.

By far the most suitable material for experimental purposes is credited to Küster-Kahn, according to reports. Numerous particularly obstinate cases were referred to him. Küster gave in 1916 a method of treating meningococci and diphtheria carriers, which consists in inhalation of steam containing sano. Sano is as yet a secret remedy, the chief germ destroying action of which apparently depends on its subchloride acids in respirable form. This elimination process follows the inhalation through the action of it with the carbonic acid in the respired air when it comes in contact with organic substances. His previously reported results with diphtheria carriers have not spread very far; by this method one of his six cases remained positive two months and a half, finally to get rid of them. Küster has not yet published his further experiments; they may be of inestimable value in the fight against diphtheria. The fact remains that we have today no positively reliable remedy for the carriers, but we have a considerable number of relatively useful ones at our disposal. Of these one or another may be of value in the particular case. It appears to be

advisable to change frequently from one remedy to another, similar to the methods used in bladder infections. At the same time chronic changes in the throat and nose must be given intensive treatment. The tendency to disregard treatment of carriers, because of the fact that we as yet have no positive remedy for them, should not be countenanced today for social reasons, if not for the carriers themselves.

PRUSSIAN FIELD HOSPITALS IN THE 18TH CENTURY

FROM THE AUTOBIOGRAPHY OF F. C. LAUKHARD[1]

TRANSLATED BY COLONEL GUSTAVUS M. BLECH, M.R.C., U. S. A.

AT THE beginning of the World War, and during the time that our forces functioned in France, some 3,000 miles from our own base and in a country bled white of men and resources as the result of prolonged combat, the Medical Department of our army made every effort to meet the demands imposed on it by the sudden enlargement of our armed forces from some thousands to over the million mark.

Unfortunately there have been those who have not taken into account these factors and have seen fit to make accusations of incompetency and neglect on this score. So long as these emanated from those who were not sufficiently conversant with the situation to speak authoritatively, or from those who had some real or fancied grievance, we could point to official records as vindication of such charges.

It is to be regretted, however, that after the return of our troops in 1919 there was considerable destructive criticism by members of our own profession. This did not originate, for the most part, from those in the higher grades, but from those who served as subalterns and took this opportunity to express their disappointment or resentment at not having been advanced in rank, or to stigmatize for real or fancied grievances those under whom they served. I served in France as commanding officer of one medium sized and one large hospital and was also fortunate enough to see a number of our frontal sanitary units. I believe that on this ground I am in a position to state that in spite of overwhelming difficulties the regular army officers in charge of hospitalization in France accomplished a feat of which they have every reason to be proud.

Some years have elapsed since the eventful eleventh hour of the eleventh day of the eleventh month of the unforgetable 1918. We should now have regained our mental equilibrium and be able to do justice to our own corps. Chronic kicking is a nasty disease. It may be partly excusable under psychic stress, but when the etiologic factors have ceased it is downright meanness not to try to rid one's system of

[1] Friederich Christian Laukhard was born in 1758 and died in 1822. He was educated in Jena, Heidelberg, Geissen and other universities. From Geissen he went to Frankfort and there, in a pre-Volsteadian burst of enthusiasm, got himself enrolled as a Prussian soldier. He served through the campaign of Friederich Wilhelm II against the French and not a great while later was released through the intervention of higher authorities.

His best known work is his autobiography, which is in six volumes, the first five published in Halle by Ruff from 1792 to 1802. The sixth volume, entitled "Letters of an Eye Witness on the Campaign of the Duke of Brunswick in 1793," was published in Leipzig in 1803 by Fleisher. So far as I know there is no English translation. An edition in two volumes, in German, and on better paper than that of the original, is published by Robert Lutz in Stuttgart—THE EDITOR.

the harmful toxins of bitterness. The best cure for a condition of dissatisfaction with the present is to learn something of the real miseries of the past.

The translation which follows this introduction is from the writings of a conscripted Prussian soldier who participated as such in the ill-fated campaign against France which began in the summer of 1792. The writings of enlisted men of that period ordinarily would be set aside by historians as of little value, but the man whom I quote was a university graduate, an academic teacher, who, by his own confession, led a somewhat irregular life. In a moment of drunken folly money was pressed into his hand by an unscrupulous recruiting sergeant and "Magister" Laukhard ceased to be an academician and became a Prussian mercenary. This, which was a calamity for him, had as its redeeming feature the fact that he, as an associate of the lower grades in military life, was able to give an analytical and critical description of conditions as they actually were and not as official documents represented them to be.

During the retreat which began September 29, 1792, the Prussian army was in a precarious condition. The weather was wretched and the roads almost impassable. Hunger, cold, rain and dysentery transformed many soldiers into living skeletons. The humane king, and such superior officers as had a feeling of compassion for those poor devils, advised them to throw away their arms and accouterments.

The sick during this retreat became so numerous that there was not sufficient transportation to carry them. Many fell from the vehicles exhausted and were left to die in the mud alongside the road.

But what were the conditions in the military field lazarets? Stringent orders had been given by the king to take good care of these sick and wounded.

Laukhard, whose autobiography bears the stamp of historical exactness and whose veracity cannot be questioned, gives us a pen picture which only one who has seen humanity at its worst can draw with any approach to reality. The following is a translation of a chapter of his autobiography.

The endless diseases, especially the dysenteries, which attacked our unfortunate soldiers in this luckless campaign necessitated the establishment of many field lazarets which were choked with sick. I, myself, have observed several of these murder holes and will honestly tell the reader what I have seen there, with the proviso that the too fastidious skip this chapter.

I heard that my friend, the noncommissioned officer Koeppel, was sick in the lazaret at Longwy. I wanted to visit him and went to the hospital without being halted by the sentry or questioned. This in

itself did not fill me with expectations of order in the lazaret itself. But I was shocked when at the very entrance I saw everything covered by human excreta, so that I could not find a spot to pass unsoiled. The general privy was altogether too inadequate for so many dysenterics and the majority of the patients lacked the strength to reach it, and as regards bed pans one scarcely saw them at all. The unfortunates sneaked up to the front of the room and there let go, how and where they could. It is despicable that I am compelled to say that I saw dead bodies in this filth.

I quickly sneaked through to the first and best chamber, but there I struck such a mephitic odor that I nearly fainted. The stench was much worse than one encounters when a privy is being cleaned out. No one thought of fumigation nor of opening the windows, and where a pane of glass was missing the opening was closed with straw or rags.

The beds of the patients were commensurate with this situation. The majority of patients slept on straw thrown on the floor; few had straw ticks and many were on the bare boards. Covers and utensils for cleanliness were not even thought of. The poor fellows had to cover themselves with their miserable rags, and as these were filled with vermin they were almost eaten alive. I stood there and did not know what to say in my anger and pity. I finally inquired about the nursing care and learned that, outside of a piece of ration bread, nothing could be seen. There was almost complete absence of medicine.

I wanted to see Koeppel, but neither the feldsher nor the ward orderlies could tell me what room he was in, so much was there lacking in special control and supervision. I even heard one say, "Whom the devil sends here, is done—for no one makes any further inquiries." Filled with nausea and anger I went away and cursed the fate of the soldiers who, when sick or wounded, are placed in such murder holes and are so poorly nursed that they must give up their eight penny lives more miserably than the most wretched cattle.

But I reflected that there in Longwy the great misery itself made inevitable the wretched situation of these unfortunate people. I knew that the king himself had issued an order to take good care of the patients and to make every effort for their recovery; even at an added monthly cost of a thousand thalers. I decided, therefore, to visit several field lazarets in order to be able to make a just estimate.

I did that in Trier, but there I saw more horrors. The lazarets were just as dirty, the care equally inadequate and the bedding as frightful as at Longwy. To this must be added the fact that on October 30–31, 280 patients were left on the street without any shelter whatever. There was no room for them in the hospitals and no one cared to take them into houses because it was generally reported that the Prussians had the plague. There croaked, yes, *croaked*, that night, more than thirty in the street. See, men, what your lives amount to in war!

The other lazarets which I saw were all of this character. How does this evil originate, through which the king, or rather, the state, loses so many men? For in this campaign very few Prussians fell before the enemy, but several thousand died in the hospitals, most of whom could have been saved if one could, or desired, to afford them suitable care.

The principal fault of the Prussian lazarets, in my opinion, is to be sought in the organization itself. The supervisors are taken from the military, without adequate experience and knowledge—mostly persons who desire to enrich themselves. Their pay is meager, but no matter how poor they are when they enter they always get out with a full purse. There is but one conclusion—that frauds in the subsistence of the sick are committed, and the whole management is so loose and confused that these frauds are not easily discovered. In such organizations all stick together for their mutual benefit. Occasionally there is found a man of probity who desires to use his influence toward improvement, but such an one is quickly suppressed. Our lieutenant, Mr. Soyaczinsky, wanted to make some improvements in the lazaret in Frankfort, but he had so much opposition on that account that his poor health became worse and he soon died. He once visited us at Mayence. "Now, Lieutenant," I asked him, "how does the lazaret appeal to you?" "Oh," he replied, "the delinquencies which I see there and which I cannot prevent will kill me."

The king is charged plenty, but the smallest possible part is utilized for the sick. I have seen feldshers and orderlies drink the wine intended for the patients. Two prostitutes in Coblentz who were the mistresses of the feldshers sold the rice of the hospital and the patients had to go hungry. In Frankfort-on-the-Main rice, barley, dried fruits and the like could be purchased very cheaply at the hospital. It was the same at Giessen. In order to make the fraud less conspicuous everything in the hospital proceeds with much mystery and in a very unorganized manner.

The ward orderlies are soldiers who can no longer serve in the companies—old cripples who are as fit for nursing as the fifth wheel on a wagon. These, whose sympathy has been deadened by the military hazing of their corporals, give the sick shameful care. It goes without saying that they are in perfect accord with the feldshers and others who have a voice in the management of the hospitals, otherwise on justified complaint they would be dismissed.

Cleanliness, the principal thing in the care of the sick, and which is of even greater importance than medical care, is so little provided that I have known patients whose shirts have rotted and whose bodies have shown holes caused by lice.

Bathing of patients by the nurses is something unheard of.

The feldshers, or, as they are supposed to be called for the past few years, the surgeons, are as a rule people who know very little of their trade, and therefore only increase the misery in the hospitals through their ignorance and inexperience. The efficiency of the superior surgeons with the regiments (about the same as the regimental medical officer of today—G. M. B.) is good, but occasionally one meets some who know little more than any common beard-scraper (referring to the barber-surgeons or feldshers—G. M. B.). The surgeons general are men of merit and insight, but the common or company surgeons as a rule are miserable quacks who have learned no more than to shave and bleed, and both in very poor fashion at that. He who can earn his daily bread otherwise and does not care for the childish pleasure of parading around

in uniform nor to carry a stick knife on his quack-side will take care not to be employed in the difficult service as a company feldsher at the miserable pay given such people. Occasionally the most skilled found in regiments are sent to the hospitals, but thereby the regiments are deprived of their most useful wound surgeons. But what can one such good man do when his colleagues oppose him and his actions?

The superior surgeons who supervise the lazarets are unable to examine and care for every patient, partly because of the numbers and partly because they are too lazy or physically incapable. They look occasionally into the wards in a very superficial manner; take reports from the feldshers or orderlies, give a few vague orders and, to appear respectable, in a few faulty Latin words and phrases leave everything to their subordinates and visit the officers clubs to play cards or otherwise amuse themselves.

Several examples have come to my knowledge as to how superior surgeons have neglected the professional care of their patients because they have lost in gambling the moneys intended for wine, vinegar and medicines, and as a result were unable to purchase these things. The inspectors, if they had done their duty, should have forced the superior surgeons to obtain the articles, but as they themselves had won the money they would have been compelled to refund their winnings if the matter had become the subject of official investigation. They kept quiet, and the poor patients remained robbed.

In addition to the incompetence of the feldshers, their number was inadequate for the work they were supposed to do. Two or three of these Aesculapian bulls were supposed to look after some 200 to 300 gravely sick soldiers, and this was common in this war.

Once I went to the hospital in Bingen-on-the-Rhine for the purpose of receiving the wounded and sick who came from the trenches at Mayence. Here, too, my anger was aroused every day. There were those there who had been received from four to five days previously and had not yet been dressed. One had his arm, another his foot shot through, and their fellow-patients expressed the most lively sympathy for them. But the feldshers and orderlies had for these poor wretches only malediction and curses.

"Am I to be blamed because you have gone and gotten yourself wounded? I wish the bullet had gone into the a—of the devil so that I need not be bothered with you. I'll dress you all right, but you must wait. Hell, I have something else to do." This I heard a feldsher say and leave the room. I said to an orderly that this was outrageous and asked whether such things were common. He replied that all the feldshers were lazy and bullies, and particularly so this one. This one sits every day in the inn and drinks. I went there at once and found this beast with a bottle of wine in front of him. I sat down and said:

"Mr. Surgeon, how can you leave these poor fellows without being dressed? It is enough to rouse anyone's pity."

He: "I have dressed six today; I need a little rest myself."

I: "But when your patients suffer so terribly and in addition have to fear cold gangrene, you ought not, I think, to give any thought to rest until you have aided them."

He: "So? He who does not want to wait may run away."

I: "Yes, if the poor devils could, I would not blame them if they had run away from that murder hole long ago."

He: "Murder hole? Sir, that is saying too much. If I report that to the officer you will be placed in arrest, do you understand me?"

I: "Oh, yes, I understand you very well, and I can see that you are as malicious as ignorant, do you understand that?"

He: "A thousand devils. I believe you wish to annoy me. Do you know who I am?"

I: "Oh, yes; I know and see that you are a heartless beard-scraper. If the French had furnished us our feldshers in order to ruin our troops through their ministrations they could not have chosen a better one for that purpose than you."

He (rising): "This matter will be taken care of, I give you my word. I am going to report this at once to the officer—he will see that I get satisfaction."

He really did go, too, but nothing came of it. I was not disturbed because I did not believe that any officer would decide in favor of such an inhuman being.

As little enough is provided for the subsistence of the patients, and as each one in authority has his "rake-off," one can easily imagine how poor is the diet of the sick. No one thinks of rational preparation of the food, nor of its rational distribution. A little miserable broth into which is put some flour, barley, or bread—that is the patient's soup. The orderlies take good care that there shall not be even an iota of fat, and so the broth tastes and looks like dishwater.

The meat in the hospitals is horrible; often it stinks and is full of maggots. It is thrown into the kettle and often only half boiled. The same applies to the vegetables. A little rice or oats; occasionally carrots, potatoes, peas, beans—for patients sick enough to die. "He who has no means of his own must starve," is a well-known saying in the Prussian army as to the lazarets.

I know feldshers who accepted money for professional services, otherwise they let the patients lie and die.

Supervision of the patients was as lax as that of the feldshers and orderlies. They can do practically what they please. Many drink liquor, eat herring and anything they can get hold of, thus rendering what little treatment they receive of little avail.

As to the thefts occurring in the hospitals, I would rather not say much. He who brings anything of value into a hospital must take care that it is not stolen by the orderlies or some of the patients.

These are the conditions prevalent in the Prussian lazarets; the Austrian are not one whit better. In them prevails the same spirit, the same disorder, the same misery; and this is the reason why so many men die in these hospitals and why the armies suffer so much as a consequence of these murder holes. I need only add that anything even that can be done, or furnished at once and without much effort, may or may not be accomplished. Frederick the Great said, "When the Princes play (carry on war), men are their toys," and if these perish by the hundreds of thousands neither the princes nor the men become the

wiser. They play again and there is no dearth of toys. This seems to me the reason why so little interest is shown in the health of those who become unfitted for active service.

But is this politically and morally good doctrine? It would seem important to so care for the sick and wounded that the effectives may not learn through them to avoid the chance which may render them as unhappy and miserable as their unfortunate invalided companions.

As I translated the above it occurred to me that in 1917–18 we drafted millions of our young men of the second decade and sent them on to fight, to be wounded, to die or to vanquish. We did not send them to the battlefield in Pullman cars, we did not ration them on cakes and ale, but we did not keep them a moment longer than absolutely necessary on the battlefield when wounded. We treated them for shock in the very trenches, and in the hospitals we gave them beds, clean linen, rational nourishment, good professional care, adequate nursing, amusement and recreation—and yet there are some who say that we did not do our full duty.

Well—"Exempla docent."

AN ELEMENTARY CHEMICAL STUDY OF THE PARATHYROID GLANDS OF CATTLE

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SINCE the discovery of the parathyroid glands by Sandstrom in 1890 and his identification of them as special glands, and not, as formerly considered, accessory thyroids, much has been written on the possible function or functions of those glands. Much has been done in animal experimentation in the study of its physiology, and cases have been studied clinically. The chemistry of the blood has been studied thoroughly, both in cases of tetany of unknown origin and in tetany artificially produced in animals. Most of the cases studied in animal experimentation have followed thyroparathyroidectomy. The removal of the thyroid as well as the parathyroids has complicated the issue, as the removal of the parathyroids alone is almost an impossible undertaking. The parathyroids are very small and difficult to recognize in the animals used for this purpose, and the uncertain number that may exist—three, four, five, or six, and their varying locations in the neck—renders any certainty as to their complete removal very doubtful, even after a careful post-mortem examination.

MacCallum and Voegtlin in 1909 demonstrated a marked reduction in the calcium content of the blood and brain during tetany, at the same time accompanied by an increase in the excretion of calcium and nitrogen. Carlson and Jacobson showed that the ammonia-destroying power of the livers of animals suffering from tetany was much decreased. They also found that, while intravenous injections of calcium did not alter the ammonia content of the blood, they did control the tetany. It was found that strontium as well as calcium salts equally well controlled parathyroid tetany. Marine discovered that the administration of calcium would only save the animal's life in the presence of active parathyroid tissue. Howland and Mariott found that the average calcium content in the serum of normal individuals was about 10 mg. per 100 c.c. In persons suffering from idiopathic tetany, the average was 5.6 mg. per 100 c.c. Greenwald discovered that the excretion of nitrogen in the urine of parathyroidectomized dogs was increased after the appearance of the tetany, and that the ratio of urea nitrogen to total nitrogen was decreased. Koch demonstrated methyl-guanidin, methyl-cyanimid and trimethylamin in the urine of parathyroidectomized dogs. He concluded that methylcyanimid is generated somewhere in the body and after parathyroidectomy this accumulates to such quantities as to cause death. Wilson,

Stearns and Jauney relieved parathyroid tetany in dogs by injecting 50 to 90 c.c. of hydrochloric acid 3.7 parts per M plus sodium chloride 7 parts per M of sterile distilled water. They came to the conclusion that the relief incident to the administration of acid might be due to a variation in the acid-base equilibrium of the body. Binger showed that orthophosphates of sodium injected intravenously might produce tetany and a diminution in the calcium content of the blood. Paton, Findlay and Burns found guanidin and methyl-guanidin in increased amounts in the blood of parathyroidectomized animals, and produced tetany in rats with these substances. Estes, Cecil, Chenu and Morel reported that the parathyroid gland contains practically no iodine. In parathyropriva in rats the dentine of the teeth and bone are deprived of calcium so that a condition similar to rachitis and osteomalacia results.

The cause of tetany and the function of the parathyroid gland is still a mooted question. In spite of all the interest shown in this little gland clinically and experimentally, it has remained almost untouched by the chemist. Because of this lack of any definite chemical knowledge of the gland itself, the writer was prompted to make a chemical study of the parathyroid gland. The problem presented many difficulties. An attempt was made to secure the parathyroids of sheep, but their small size rendered it very difficult. This was abandoned after several attempts in which the few glands secured were not sufficient for any extensive study.

The parathyroid glands of cattle are easily found because of their size and location. Enough of these glands were secured for chemical study. Some of the glands were sectioned, stained and examined under the microscope to make certain that parathyroid tissue was dealt with. The bovine parathyroid must be differentiated from the lymphatic glands found in the neck, as they are covered with fat and very often of the same size. The parathyroid gland is very firm, the lymphatic gland more easily compressible between the thumb and forefinger. A stained and mounted section, examined under the microscope, reveals a capsule with very rarely an imperfect septum dipping down into the glandular substance. The glandular substance consists of irregular cells, varying in shape and size, and richly nucleated. It resembles embryonic tissue.

Fresh glands were secured in the morning and watery extracts prepared and treatment of the glands, preparatory to a search for the purine bodies, was well under way in the afternoon of the same day. In the work carried on by the writer only fresh glands were used, and he wishes to call special attention to this fact.

From the preliminary analysis of the fresh bovine parathyroid, the following results were obtained: Nitrogen by the Kjeldahl method, 7.08 per cent; ash, 0.472 per cent. An analysis of the ash showed that it is rich in phosphorus, that sulphur is present and that calcium is absent, or, if present, in such small quantities as not to be detected by the usual methods.

A watery extract of the glands, prepared by allowing the finely macerated glands to remain in pure distilled water at 40° C., is faintly acid to litmus and faintly acid as indicated by rosalic acid and lachmoid. A white amorphous precipitate, small in amount, is secured by adding phosphotungstic acid.

The protein or proteins of the bovine parathyroid are readily soluble in dilute sodium hydroxide solution and fairly soluble in pure distilled water at 40° C. They are insoluble in cold $\frac{1}{10}$ normal sodium chloride solution and in cold dilute acids. They are precipitated by nitric acid and heat, by mercuric chloride, copper sulphate and picric and tannic acids. Heller's cold nitric acid test gives a heavy white ring at the junction of the two fluids. The xanthoproteic and Millon's reactions occur, while Adamkiewicz's reaction and the Biuret reaction do not occur.

Of the purine bodies, xanthine is present in relatively large amounts. A solution, prepared by boiling finely divided glands from which the fat has been carefully removed in sulphuric acid 5 parts per M of pure distilled water for four hours, and from which the proteins have been precipitated by basic lead acetate and the lead removed by hydrogen sulphide, when rendered alkaline by ammonia, gives an abundant flocculent, yellowish-brown colloidal precipitate on the addition of ammoniacal silver nitrate. This precipitate, with the addition of a little urea, was dissolved in boiling hot nitric acid of sp. g. 1.1, and the solution filtered boiling hot. On cooling no precipitate was found. This was again filtered and ammonia added. A yellowish-brown colloidal precipitate, approximately of the same bulk as formerly secured, separated out. This was treated with hydrogen sulphide and allowed to stand over night. The precipitate appeared as a yellow amorphous substance, with a few plates intermingled, under the microscope. Guanine, hypoxanthine and adenine were not found.

After precipitation of proteins by basic lead acetate, etc., in the preparation for the isolation of the purine bodies and after precipitation by ammoniacal silver nitrate, identified as xanthine, the clear filtrate gives a crystalline precipitate with picric acid. The crystals appear faintly yellow under the microscope and are shaped like bull-moose horns with many irregular projections. Its melting point is 120° C.

and was found to be readily soluble in water. This precipitate is more abundant when the glands are boiled in dilute hydrochloric acid 10 parts per M of pure distilled water. Its solution in water gives a precipitate of red needles with sodium hydrosulphide. These were identified as picramic acid with a melting point of 168° C. This picrate has been designated by the writer as the *Unknown Picrate "A."*

After the stage for precipitation of the purine bodies in a solution prepared by boiling the glands in sulphuric acid 5 parts per M, the proteins precipitated by copper sulphate and the copper removed by hydrogen sulphide, a precipitate of large monochromatic three-sided bars resulted on the addition of picric acid. It loses its crystalline sheen at 148° C. and chars at 270° C. This picrate differs from that best obtained from a solution in hydrochloric acid or in the solution in which the proteins were removed by basic lead acetate. It is sparingly soluble in cold water and quite readily soluble when warmed. This picrate has been designated as the *Unknown Picrate "B."*

On adding phosphotungstic acid to a solution obtained by boiling the glands in hydrochloric acid 10 parts per M and filtering, an abundant amorphous white precipitate results. This precipitate does not dissolve in hot concentrated hydrochloric acid, nor does it give the xanthoproteic or Millon's reactions.

SUMMARY

1. A watery extract of the parathyroid is faintly acid in reaction and contains protein bodies.

2. The ash is rich in phosphorus. Sulphur is present.

3. The proteins are readily soluble in dilute sodium hydroxide solution, suggesting the presence of nucleoproteins. They are also fairly soluble in pure distilled water at 40° C. They give a marked Millon's reaction, placing them in the phenol group.

4. Xanthine is the predominant purine body.

5. Precipitates (*Unknown Picrates A and B*) can be isolated from dilute solutions of sulphuric acid and hydrochloric acid, previously boiled. One consists of crystals with a characteristic tendency to form double horns with many irregular projections and has a melting point of 120° C. The other crystallizes out as large monochromatic three-sided bars that lose their crystalline sheen at 148° C. and char at 270° C.

6. An abundant amorphous white precipitate is obtained from an extract of the glands boiled in dilute hydrochloric acid that does not react as the proteins do.

The writer expects to report his findings as the result of a more thorough study of the watery extract, the Unknown Picrates A and B and the phosphotungstic acid precipitate from a dilute hydrochloric

acid extract of the glands, in an effort to identify them, or determine, whether or not, they may contain, or be compounds of, some active substance peculiar to the parathyroid gland. Photomicrographs of the Unknown Picrates will be included in the next report.

ACKNOWLEDGMENTS

I wish to acknowledge my obligations to P. M. Glasoe, Ph.D., and E. O. Ellingson, Ph.D., of the Department of Chemistry of St. Olaf College, Northfield, Minn., for their guidance and help, to Thomas Nelson & Sons for their various extracts of articles, some of which are included under Bibliographies, and to Swift & Company for their permission to secure fresh bovine parathyroids.

BIBLIOGRAPHY

Massaglia, Dr. A. C.: "The Internal Secretion of Sandstrom's Glands: Parathyroid Hypofunction and Eclampsia." Endocrinology, May, 1921, Vol. V, No. 3.

Berkeley and Beebe: "A Contribution to the Physiology and Chemistry of the Parathyroid Glands." Jour. Med. Research, 1909, 20:149.

Boothby, Walter M.: "The Parathyroid Glands." A Review of the Literature. (With over 14 pages of references, dating from 1851 to 1920.) Endocrinology, July, 1921, 5:403–440.

Hammarsten and Hedin: "A Text-Book of Physiological Chemistry." Trans. by John A. Mandel, p. 377. New York, John Wiley & Sons, 1914.

Matthews, Albert P.: "Physiological Chemistry." P. 654–656. New York, W. Wood & Co., 1920.

Voegtlin, C.: "The Physiological and Pathological Importance of the Parathyoid Gland from the Experimental Aspect." Surg., Gynec. and Obstet., 1917, 25:244.

DEFENSE OF THE USUAL METHOD OF THE CALCULATION OF ANNUAL DEATH RATES

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MAY I be allowed space to call attention to the basic error in the arguments presented by Major Milton W. Hall, M.C., in the article by him "A Possible Fallacy in the Calculation of Annual Death Rates," which appeared in the February, 1923, issue of the MILITARY SURGEON, page 157, et seq.

The basic error in his arguments is very evident and probably would be apparent to any one of the readers of this journal who has mastered the essential principles of percentages and ratios. Consequently, it seems almost unnecessary to ask for even a limited amount of space to point out the author's fallacy. Even the mention of the subject of statistics is, however, disagreeable to many, and some may possibly accept as true a plausible, though a fallacious argument, through disinclination to study the question more carefully. It is also especially desirable to point out the error in this article since no medical officer should be discouraged in the use of the statistics as published in the annual reports of the Surgeon General of the Army through doubt being cast upon their accuracy. Consequently the following is submitted.

Major Hall is correct in his assumption that annual mortality rates for military commands which fluctuate violently from month to month during periods of mobilization or demobilization are not as reliable as a basis of comparison as are similar rates for communities or commands which maintain a more constant average during the year. He is also correct in his assumption that this may lead to errors in deductions, and especially so in the presence of great epidemics.

As is well known, however, even in civil communities where the strength or population remains more nearly constant, correction in the annual gross death rates are necessary. For example, allowance must be made for the difference in the age groups present. Thus New York City, with its large influx of adults from foreign countries, as well as from other sections of our own, has proportionately fewer children than certain cities in the interior, to which few adults migrate. Consequently correction must be made for this difference, since more deaths occur among children from certain diseases, and a greater number among old people from others.

Allowance must also often be made during interdecennial census

periods for unusual shifts in the population, such as occurred during the latter half of the decade from 1910 to 1920.

Both of these illustrations are introduced to show how futile it is for anyone to attempt to deduce conclusions even from civilian vital statistics without a thorough knowledge of the underlying conditions of the community for which they were compiled. The fact that annual rates should be used with caution is, however, not a new discovery, but has been known for many years, and was stressed again and again by Major (later Colonel) Charles Smart in Part Third, Medical Volume, Medical and Surgical History of the War of the Rebellion. This fact has also been recognized by all modern writers who are at all qualified to discuss vital statistics. Annual rates have, however, been used extensively in the Surgeon General's Annual Reports, as well as in other publications of vital statistics, since they are, generally speaking, our most reliable crude measure of morbidity or mortality. These rates are also used generally, since it is necessary to condense the statistical material, which is always quite expensive to print. When the strength of commands are changing daily, or when great epidemics occur, it would be desirable to compare the vital statistics by days, if such were practicable.

Unfortunately, the remedy to correct such imperfections as exist in annual rates for war military commands is not so simple as Major Hall has assumed. His argument in brief is that the simple average of twelve monthly rates is the correct annual rate, and this without regard to the varying strength from month to month. In other words, he proposes to use a simple arithmetical average, condemning as worthless a weighted average, such as it has been customary to use.

It should be at once apparent to anyone that all ratios, including percentage rates, cannot be averaged without reference to the bases upon which they were calculated. Thus as a simple illustration:

$1,000 at 6 per cent for one year =	$60
2,000 at 7 per cent for one year =	140
3,000 at 8 per cent for one year =	240
$6,000	$440

Now, according to Major Hall's method of averaging ratios, which necessarily includes percentages, without regard to the bases, the average rate here would be 7 per cent. As a matter of fact, however, the average percentage rate is not 7 per cent but $440 divided by $6,000 or 7⅓ per cent. In like manner:

$3,000 at 6 per cent for one year =	$180
2,000 at 7 per cent for one year =	140
1,000 at 8 per cent for one year =	80
$6,000	$400

Here again the average percentage rate is not 7 per cent, but in this case is $6\frac{2}{3}$ per cent.

Again let us take a familiar example of the calculation of the average height of a number of men. Thus:

Men	*Height in feet*	*Total height for group*
10	5	50
20	6	120
30	7	210
60		380

Here, according to Major Hall's method, the average would be 6 feet. It is clear that he would then take the average of the three measurements but not the average of the height of the group of men, which is 380 divided by 60, or $6\frac{1}{3}$ feet. Reversing and assuming the greater number of men with the smallest dimension, we have:

Men	*Height in feet*	*Total height for group*
30	5	150
20	6	120
10	7	70
60		340

Here the average height of the group is again not 6 feet but 340 divided by 60, or $5\frac{2}{3}$ feet. It is then clear that all averages of measurement, percentage rates, and ratios per any number must take into consideration the magnitude of the bases upon which they are calculated.

Now in considering the illustrations used by the author let us take first his Table I, page 162. He argues that the correct annual rate for both groups of men was 12.01 per 1,000, and not 15.94 for the A. E. F. group and 12.72 for the group in the United States, as shown by his own calculation. One sees at once that his argument is fallacious since, according to his assumed table, it was during the period when the highest death rates occurred among the group in the A. E. F. that the strength there exceeded that in the United States. Consequently, with a greater number of thousands of men, more deaths must have occurred, which materially raised the total and the average for the year. The author says that it did not, but that the same number occurred. We have been taught that 4 divided by 2 equals 2, or that 15,939 divided by 999.680 thousands equals 15.94 per thousand. But he says no, that it equals 12.01. To repeat then, it is obvious that, according to his assumed problem, more deaths did occur in the A. E. F. because the highest death rates occurred there when a greater number of men were present.

In regard to the hypothetical camp rates as shown in Tables II,

III, and IV, the same fallacies exist in his argument. Necessarily more deaths occurred and the annual rate was higher in Camp B, where the maximum strength was during that period when the greatest number of men per thousand died, than at Camp C where the maximum number of men was present during the period when the minimum rates prevailed; or at Camp A when the strength was the same for the months which had the maximum as well as for those which had the minimum rates.

His argument based on Fig. 1 appears more plausible and might be accepted, if no more than casually inspected. But here the same basic error of considering ratios apart from their bases exists. Now it can be easily shown that, in two series of height or of any magnitude, one can be constantly higher than the other, and yet the second have a higher average, provided a sufficiently higher percentage of people or objects in the second series have the greatest heights or magnitude in the series, with a sufficiently large percentage of them with the least magnitude in the first group. Thus:

1st Series

Height in feet	*People*	*Total height of group*
5	30	150
6	20	120
7	5	35
	55	305
	Average.........	5.54 feet

2nd Series

Height in feet	*People*	*Total height of group*
4	5	20
5	20	100
6	30	180
	55	320
	Average.........	5.81 feet

It is clear that the author's failure to recognize the importance of the magnitudes of the basic groups is again responsible for his error. Thus it can be readily seen that the annual rate at Camp B (Table III) was the same as at Camp D (Table V) and at Camp E (Table VI) despite the constantly lower rate at the first, due to the greater number of men being at Camp B during the period when the maximum rates prevailed, whereas the maximum number of men was present at Camp E during the period when the rates there were lowest, with an equal number at Camp D both when the maximum and minimum rates existed.

Although Major Hall is in error in his reasoning, yet his article

should serve to impress, upon all who read it, the obvious fallacy of considering only one rate or factor when studying vital statistics. Every factor should be carefully considered and, if possible, some deduction should be drawn from the entire body of evidence. It is clearly unfair to compare the annual rate for a camp which existed practically only during the epidemic period of 1918 with those for other camps which existed during the entire year, and for which, consequently, low monthly rates, as well as high ones, are considered. It is also manifestly unwise to take, as has been done, the five months—that is, May through September, 1898—of the Spanish American War and to build from this, the maximum typhoid period, an annual rate for typhoid fever for comparison with an annual rate for the Civil War or World War based upon an entire year, including the winter as well as the summer months. Such statistics are best studied by comparing monthly rates, month by month, but not by comparing the arithmetical average of these monthly rates for the year.

SANITATION ON ATLANTIC TRANSPORTS

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THIS article is written in the belief that it will be of interest to the service to know the sanitary measures in vogue at the Headquarters, A. T. S., Brooklyn, N. Y., to insure cleanly accommodations, minimum danger from disease and, last but not least, food of unimpeachable quality.

The slogan of the General Superintendent, A. T. S., is "Safety First"; its synonym in the language of the sanitarian is "Prophylaxis."

The prophylactic measures that are carried out under the supervision of Headquarters, A. T. S., are responsible for the high sanitary standard maintained on our Atlantic transports. The execution of these sanitary measures is dependent on multiple inspections.

The *modus operandi* will be considered under the following headings:

1. Physical Inspection of Transports.
2. Mechanical Cleaning of Transports.
3. Physical Inspection of Crew and Passengers.
4. Food Inspections.
5. Water Inspections.
6. Remarks.

PHYSICAL INSPECTION OF TRANSPORTS

A daily sanitary inspection is made by the transport surgeon, who renders a report of same (in writing) to the ship's master, C. O. of troops, quartermaster agent officer, and turns in a copy to the medical superintendent at the completion of each voyage.

A monthly sanitary report is accomplished, based on daily inspection and matters of sanitary interest.

On the arrival of the transport at Brooklyn an inspection is made by a representative from the Inspector General's Department and port authorities, accompanied by the chiefs of the various departments aboard ship; to wit, deck, stewards, engineers and medical. A written report of a general character is prepared by the inspector from the Inspector General's Department and a sanitary report by the medical superintendent.

Each transport is subjected to a rigid general inspection on the day of sailing by an officer detailed from the Inspector General's Department and representatives from Headquarters, A. T. S.

Preliminary inspections, informal in nature, are made by officers attached to the Headquarters, A. T. S., covering the activities of the

various departments aboard transports with the sole endeavor to attain a cooperation in mechanical efficiency and cleanliness.

The sanitary inspector has but one object in view, namely, to impress the chiefs of the departments and their personnel aboard the transports with the fact that he makes his inspections in a spirit of helpfulness and not of criticism.

The writer considers that the most important phase of the work of the sanitary inspector is to instruct the heads of the departments and their subordinates in the fundamentals of sanitation and to impel them to realize fully, by precept and example, that environmental cleanliness is necessary if they would have personal cleanliness. The large majority of the personnel aboard transports know that disease is transmitted by flies, lice, fleas, mosquitoes and possibly bed bugs, roaches and other insecta, and it is not hard to impress them with the fact that dirt or filth attracts these propagators of disease.

MECHANICAL CLEANING OF TRANSPORTS

At the end of each trip, or when a transport is placed in commission, the following methods are instituted.

A general sanitary survey is made by the medical superintendent for the purpose of obtaining data from which an outline of necessary work is constructed, as a guide for the sanitary squad. This squad is composed of enlisted men from the Medical Department who function under the direction of Headquarters, A.T.S.

(*a*) *Sterilization.*—All mattresses and pillows, "the foregoing equipped with covers," blankets and linen are sterilized. All articles except linen, which is sent to the laundry, are taken from the transport to the sanitary process plant and exposed to raw steam, under 15 or 20 pounds pressure at a temperature of about 260° F. for thirty minutes, as are all life-belts that have been in use. Curtains, rugs, metal springs, etc., when infested, are also treated by this process, after having been saturated by insecticide before removing from the transport.

(*b*) *Application of Insecticide.*—While the mattresses and other articles specified are being sterilized, the denuded areas are sprayed with an insecticide and all removable fixtures are taken down and backs brushed or sprayed with same. Closets, clothes presses, etc., are thoroughly treated with insecticide, special stress being laid on filling the cracks and crevices with our insecticidal crack-filler or shellac, the latter being preferred where cracks are few and minute.

Articles that are being handled daily are rarely found to contain insecta or their ova. Books and papers of any value are examined for the presence of insects and their eggs, while the worthless are destroyed.

On completion of the treatment of the hospital areas, staterooms,

crew and troop quarters aboard the transports, the sterilized mattresses, blankets and other equipment are returned to the transport.

The trucks that are used in transportation are thoroughly swept and sprayed with insecticide. The arrangement of the sterilizing plant is such that all contaminated articles (unsterilized) are received in one end of the plant, placed in a sterilizer equipped with double doors, one opening into the end of the plant where unsterilized bedding and fittings are received, and the other into the shipping section, where only sterilized articles are stored prior to return to the vessels. The men in the receiving end of the plant do not operate in the shipping section or do not handle the sterilized articles.

It is considered that our technique is sound and that re-contamination of sterilized equipment before being returned to the transports is impossible or the danger, at least, reduced to a minimum.

Mess-rooms, galleys, store-rooms and pantries are treated with the insecticide after careful inspection for the location of nests of cockroaches and ants which are found chiefly in these areas.

Sodium fluoride (fluorol) is used freely in cracks and crevices after the liquid insecticide has dried.

The sanitary squad completes its work by spraying with a combined disinfectant and insecticide all bath-rooms, bath-tubs, wash-basins and water-closets aboard transports.

On the arrival of the transports at any other than their home port, the transport surgeons, acting under instructions from Headquarters, A.T.S., have the pantries, mess-rooms, toilets, all wash-basins and galleys sprayed with the combined disinfectant and insecticide. Any other area showing signs of infestation by insecta or coming under suspicion is treated as above.

(*c*) *Direct Flame.*—In addition to the use of insecticides, all metal work, in passenger, troop and crew quarters, where possibility of infestation by the bedbugs and other parasites must be considered, is burned over by direct flame, using gasolene blow torches equipped with spreaders which, by increasing the flame area, greatly facilitates this work.

Following closely on the heels of the sanitary squad are the scrubbing and cleaning gangs, who scrub with soap and water those areas that have been treated by the sanitary squad. These, in turn, work under forced draught in order to keep ahead of the painters. The details from the crew, on whom devolves the work of painting, succeed the scrubbers so closely that they are rarely more than half an hour behind the soap and water artists. The final touches consist in the polishing of brasses and bright work, in all no small job.

PHYSICAL INSPECTION OF CREW AND PASSENGERS

Every applicant for a position in the crew of a transport must undergo a thorough physical examination and present to the transport surgeon sufficient proof of vaccination against smallpox and inoculation for immunity to typhoid and paratyphoid or pass through the ordeal of vaccination and inoculation. Further, a weekly physical inspection of all members of the crew is made by the transport surgeon and the result incorporated in the monthly sanitary report. Lectures on social hygiene are delivered to the crew by the transport surgeon twice a month.

The first and second class passengers are physically inspected within twenty-four hours prior to embarkation, the majority being examined at the gangplank shortly before the sailing hour. This examination is for the detection of communicable diseases and consists of inspection of the throat, nose, conjunctiva and palpation of the cervical glands. All doubtful cases are held for further examination.

Passengers showing no symptoms of a communicable disease receive a certificate from the examining surgeon, which, with their transportation request, they are required to present to the embarkation officer before being assigned quarters aboard the transport.

The transport surgeon makes a physical inspection of passengers within twenty-four hours of debarkation, and any cases of communicable disease and contacts are segregated and reported to the port medical authorities for disposition.

The troop class passengers are inspected before leaving their home stations for port of embarkation and, if from Fort Hamilton or Fort Slocum, are accompanied by a certificate stating that a physical inspection was made by a medical officer within twenty-four hours of arrival of the troops at the port. Troops arriving without having received a physical inspection within twenty-four hours must undergo same before embarkation. All troop passengers are required to take a shower bath every third day, and a certificate stating that this order was carried out is rendered the transport surgeon by the commanding officer of troops before debarkation.

Though the troops arrive with a medical certificate, it has been found expedient to make an inspection of the troop passengers immediately following embarkation. This has resulted in the detection of a large number of soldiers infected with communicable diseases usually of the parasitical (skin) type as trichophytosis, scabies, pediculosis, etc., the newly found cases frequently reaching as high as 10 per cent of all troop passengers.

FOOD INSPECTIONS

All foodstuffs are examined at ship side by government food experts, after which they are reexamined by the port steward and ship's steward, who may refuse to accept any article they think below standard. The, practice of multiple inspections of food is carried still further, inasmuch as during the daily sanitary inspections of the transport (as discussed above) the transport surgeon takes special note of cold storage areas, temperature of the rooms and the condition of the contents. He also makes a detailed inspection of the dry store rooms, noting in particular the condition of the flours, cereals, etc.

All food handlers, cooks, waiters, storekeepers, butchers, etc., are examined in compliance with Army Regulations every six months, for the purpose of detection of cholera, typhoid or paratyphoid carriers.

WATER INSPECTIONS

Samples of water from the domestic tanks are sent to the corps laboratory within twenty-four hours after the ship has docked and once a week thereafter while in port. In the event of an adverse report from the laboratory, all water in the domestic tanks is chlorinated, pending sanitary survey to locate source of contamination, and preliminary to chlorination all water used for domestic and drinking purposes is boiled. Before taking water aboard a transport a sample of same is examined or, if the water comes from an area where the supply is examined by the public health department, a report is obtained from them as to potability and a copy placed in transport files.

Frequent examinations of water tanks are made while in port, to ascertain the condition of lining and amount of sediment. If cracks are present or obvious sediment, a scrubbing of lining and recementing is done if circumstances permit, otherwise the tanks are thoroughly flushed.

REMARKS

The "Army Transport Service" is equipped with a battery of three steam sterilizers located in the basement of the huge storehouse at a convenient distance from the piers. This plant, known as the Sanitary Process Plant, has a capacity of from fifty to one hundred mattresses per hour with thirty-minute exposure.

In a corner of the sanitary process plant the insecticide used by the sanitary squad is manufactured, at an expense to the Government of from eleven to sixteen cents per gallon, dependent on the market prices of materials used in the admixture.

In my experience during the past four years I have found that carbolic acid is to be preferred to any other ingredient (or article) as

the essential element in insecticides when questions of efficiency, non-inflammability and economy are to be considered.

The fumigants of value HCN and SO_2 are too dangerous and expensive to be handled by novices. In the opinion of the writer the methods discussed in this paper and adopted by Headquarters, A.T.S., of this port have not only proven efficient but practical and economical.

The sanitary squad is organized as follows: 1 foreman, 2 mechanics, 2 torchmen, 1 sprayer. The mechanics take down standees, any removable fixtures and fittings and remove drawers from presses, etc., preparing the way for the sprayers and torchmen, who spray and burn over areas specified by the medical officer in charge. This squad in the balmy days of the A. T. S. consisted of twenty civilian employees, two assigned to the sanitary process plant and the remaining eighteen divided into three squads, each having a foreman with five men under him. These men were chosen and trained, by the medical officer in charge, in the detection and extermination of insect pests. The foreman of squad designated to perform the work accompanied the medical officer when he made his sanitary survey.

Dish Washing.—Dishes, cutlery and cooking utensils, after scraping and cleaning, are first washed in hot soapy water, then rinsed in boiling water and drained dry. This system, when properly supervised, has proven satisfactory, as the supply of steam is unlimited and available at all times.

The success of the above system is dependent on close supervision, which is not always practicable; therefore it has been deemed advisable to recommend the installation of dish-washing machines.

Disposal of Waste and Sewage.—All mess-rooms, pantries, galleys and sculleries have an ample supply of metal waste cans, capacity of 15 to 30 gallons, which are equipped with covers. All waste, garbage, etc., is placed in these cans, which are never more than half filled in order to facilitate handling and prevent strewing the deck and adjacent structures with contents. At sea, these cans are emptied into the ocean once a day through chutes which are conveniently located to sculleries and galleys. The waste chutes are thoroughly cleaned after being used, and their watertight covers are securely clamped to prevent promiscuous use. While at port, harbor regulations are complied with, and the partially filled refuse cans at a stated hour during the day are collected and taken to the piers, where they are turned over to the port authorities for disposition. When the empty cans are returned they are immediately rinsed out, scrubbed and treated with raw steam, after which they are ready for use.

The first, second class and crews' water-closets are of the single

hopper and hinged type. The first two named are equipped with the mechanical flusher, while the crews' have the automatic flushing system.

The troop latrines are open troughs with rail seats and, when in use, are constantly flushed, having at all times a minimum of 2 inches depth of water in the trough.

The sewerage from all water-closets, scuppers, baths and wash bowls drains into the sea through a well-planned system fitted with necessary traps and so constructed that all pipes and traps are accessible and can be readily cleaned and flushed.

The decks are drained through scuppers that connect with the main sewage system, except the well decks which drain through hawser holes and scuppers in gunwale.

The point of exit of sewerage is placed as near the sea level as possible to prevent undue contamination of the sides of the vessels.

Bedbugs and Roaches.—To you who have followed me thus far I wish to tender an apology for the succeeding dissertation, which may appear to have an hyperbolic strain running through it, but as I am going to sign this statement I feel assured that you will accept it "*in toto.*"

A few words relative to the two most common insects that we have to combat aboard ship, the bedbug and the cockroach.

The *Acanthia lectularia* or the cosmopolitan bedbug is the species most commonly found aboard transports in temperate regions, though occasionally we will get a few of the *Rotundata* (tropical type) and have obtained a number of *Conorhini sanguisugae* (Mexican bedbugs) that were originally known as destroyers of the *Acanthia.* I know they will kill the cosmopolitan bedbug and probably also the tropical bedbug, if interfered with when seeking food or in the absence of animal hosts. The young bedbugs are cannibalistic like their nocturnal friends, the rats, and I have frequently been able to demonstrate that the neophyte will, if unable to get food, attack the adults, eventually killing them. It appears to be the general belief that the cockroach is an enemy to the bedbug. I will agree with the sponsors of this idea in part, but, as the result of a number of years observation of the insecta in captivity and at large, I can state that they have lived in perfect amity for weeks at a time, through periods of plenty and during starvation.

I have frequently placed Croton bugs in an observation box 6 by 6 by 6, having glass sides and top, with an equal number of bedbugs and a batch of their ova, and during the thirty to forty days the bugs lived together in these restricted quarters, with starvation staring them in the face, I have never observed signs of enmity. I must admit the

roaches ate the ova during their first week of confinement, but I can safely say they will not eat bedbug eggs if other food is within reach.

Many ships that I inspected during the late war were badly infested by both roach and bedbug; in fact, I have rarely seen a ship infested by one of these pests that did not have its quota of the other.

The above data are relative to the Croton bug (or cockroach) which is commonly found on our ships.

The oriental cockroach is occasionally discovered aboard ships from the Pacific Coast, and rarely do we come across a specimen of the American and Australian species, the monster winged roaches. I have known these giant roaches to kill their Croton relatives, and, besides personally observing the fact, I have been informed through a number of sources that the large species, if they get a foothold, will drive the Croton from a ship.

Flies and Mosquitoes.—The *Musca domestica* (common housefly) holds first place aboard transports, with the occasional presence of the *Stomoxys calcitrans* (barn flies) which resemble the *M. domestica*, differing from it by being a biting fly; it, with certain of the *Tabanidae* (horse-flies), visits the transports while in port, from nearby stables, cattle boats or yards. The routine antifly measures—screens, traps, poisons, paper, swatting and, above all, the fly proofing of all food, to wit, covering and screening—are carried out.

Mosquitoes are a negligible quantity aboard our transports at sea. It is only in port that we need to consider them seriously, and the important ones, from a sanitarian's standpoint, are met with in the Canal Zone and Philippine Islands.

We are concerned chiefly with the family *Culicidae*, owing to three species from this family being known carriers of disease, the *Culex fatigans*, *Stegomyia calopus* and the *Maculi pennis*, the first named being charged with spreading dengue and the second and third respectively designated as transmitting yellow fever and malaria.

The transport surgeon institutes a vigorous campaign against the mosquito by means of lectures and practical talks on these insects in their rôle as disease carriers.

Special instruction is given to the medical detachment and crew to enable them to recognize the *Culicinae* and *Anophelinae*, and they are further thoroughly trained in the methods in vogue for the destruction of these pests.

Mosquito control aboard our transports consists in swatting, screening and destroying by fumigating with cyanide or sulphur gases. Pyrethrum is often used; the fumes from the smoldering pyrethrum stupify but do not kill the mosquitoes, and one must sweep them up and de-

stroy them before they resuscitate. It is well to cover all ports but one during the burning of the pyrethrum; the majority of the insects, being attracted by the light, will be found lying on the floor below the uncovered port hole.

The transport surgeon, officiating as sanitary adviser of the commanding officer aboard the transport, recommends the promulgation of regulations relative to antifly and mosquito measures.

During the daily inspection the transport surgeon is on the lookout for negligence in the carrying out of the antifly and mosquito measures.

Recreation.—The type of transports under control of these headquarters has a very limited deck space, resulting in restriction of outdoor exercises by troops; this condition is met, when the transport is carrying its full quota, by so organizing that all troop classes get some exercise out of doors during pleasant weather.

For recreation the passengers have games, music, the radiophone, wrestling, sparring bouts and reading. Books may be procured from the ship's library.

Ventilation.—The importance of this subject cannot be overestimated in troop transportation. Dryness of quarters, ample air and floor space are judged as of vital importance. The precluding of overcrowding of troop areas makes it possible, by means of the modern ventilating system with which the transports operated by these headquarters are equipped, to maintain the air in troop quarters at the proper temperature, humidity and freedom from drafts necessary to comfort and health.

It is my experience that, given a dry ship equipped with a modern ventilating system with adequate fans and sufficient floor and air space to prevent overcrowding, and fairly pleasant weather, the subject of ventilation may be forgotten.

During bad weather the ventilating system of troop sections receives serious consideration by the transport surgeons, who make frequent inspections daily of the occupied troop areas, noting in particular the temperature and humidity and keeping in touch with the chief engineer, to whom is reported any deficiency in the mechanical operation of the system. Windsails are always on hand ready for use in emergencies or as a supplementary system.

Anti-Rat Measures.—Anti-rat measures are instituted at this port in compliance with Public Health Service Regulations and consist of breasting the ships from piers and other ships, the equipping of all shore and boat lines with rat guards, lighting of gangplanks at night, also the whitening of same and fumigation of transports every six months, if from

clean ports and after each trip if from infected ports, per Public Health Service requirements.

All transports are supplied with rat traps, and on the daily inspection one of the duties of transport surgeon is to look for signs of the rodents.

In the opinion of the writer the most important measure in rat elimination is one that is not a regulation of the Public Health Service but is strictly complied with on Atlantic transports; to wit, the thorough rat-proofing of all subsistence store-rooms and at night placing all cooked foods in rat-proof receptacles; briefly, we starve the rats, for these animals will not remain where they cannot get food.

In substantiation of the efficiency of our anti-rat measures, I will state that the Public Health Service, which fumigates the transports, has yet to find the first rat.

AIRPLANE DEAFNESS AND ITS PREVENTION

By Captain VERNER T. SCOTT
Flight Surgeon, United States Army

AIRPLANE deafness is that temporary deafness caused by the explosions of an airplane motor. It occurs when flights are of one hour duration or longer and lasts from one to several hours, depending upon the length of the flight. Industrial hygiene warns of deafness in those associated with loud noises. E. Eugene Holt[1] called attention to "Boilermaker's deafness" occurring in workmen making steam boilers, stating that frequently these men became permanently deaf. Examination disclosed the fact that the deafness and condition of the ear did not differ materially from that of chronic catarrhal otitis media. Holt found the exciting cause traceable to the "constant agitation of the joints of the ossicles thereby exciting inflammation of these structures and producing more or less ankylosis of them, particularly of the stapes."

Jobson[2] in England, working with infantrymen exposed to gun fire a few hours to several months, found a definite type of deafness which he calls "normal gun deafness" and concludes that exposure to gun fire often produces a permanent deafness.

That airplane deafness is a temporary condition is due to two factors —the comparative shortness of exposure to the motor explosions and to the partial protection afforded the auditory apparatus by the helmet. An aviator who recently flew across the continent in daytime hops stated that after flying six or seven hours his deafness and "ringing in the ears" continued all night and sometimes until noon next day. In the average cross-country flight of two hours, the deafness will last from one-half to one hour. During this deafness the ordinary conversational tone is unintelligible and conversation can be carried on only in very loud tones.

Nothing distinctive is found on examination of the tympanum. Occasionally congestion of the upper part of the tympanum is seen in those who have been flying at high altitudes, the congestion being caused by changes in the atmospheric pressure.

It is believed by some not familiar with aviation medicine that the deafness is caused by the changes in atmospheric pressure rather than the noise of the motor. That atmospheric pressure is not a factor in producing airplane deafness is demonstrated daily at the School of Aviation Medicine, Mitchel Field, Long Island. This school has for

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[1]E. Eugene Holt: American Otological Society, Vol. 3.
[2]T. B. Jobson, M. D: Lancet, October 13, 1917.

teaching and research purposes a large "low pressure chamber" in which the barometric pressure can be lowered from 760 mm. (sea level) to 140 mm. (equivalent to 35,000 feet above sea level), and although neither a hat nor a helmet is worn during the experiments there has never been a case of deafness experienced by anyone "going up" in this chamber.

If the changes in atmospheric pressure were a factor in producing deafness it would occur more readily here than in actual flight because of the more rapid change in pressure. To gain the same rapid changes of atmospheric pressure in actual flight an airplane would be compelled to ascend at the rate of 1,000 feet per minute to 20,000 feet and descend at the same rate. This, of course, would be done only in exhibition flying.

PREVENTION

The simplest, safest and most practical arrangement to prevent airplane deafness is that made by sewing two powder puffs (the ordinary powder puff used by the ladies) on the inside of the ear flaps of the helmet, making sure the puffs fit snugly over the ears. It is very essential to have a snug-fitting helmet; an ill-fitting helmet will balloon out along the sides of the face at the first blast of the propeller and will not only amplify the noise but will catch all the dust and wind.

The use of ear plugs made of hard rubber, paraffin or wax should be discontinued. They not only have a tendency to irritate the auditory canal as any other foreign body, but they are unsanitary and hard to keep clean. Another objection is that, being small, they are frequently lost when needed.

Cotton plugs find favor with some fliers, but their use is not recommended; cotton fibers and cerumen collect in the canal, causing irritation and deafness until removed by a physician.

The powder puffs in the helmet can be removed and cleaned easily, cannot possibly irritate the auditory canal, and are always with the helmet. They block the loud explosions of the motor but allow sufficient noise through to determine a missing motor. Altitude and the rush of air prevent the powder puffs from becoming uncomfortably warm in summer. Care should be taken to select a powder puff of wool or a mixture of wool and cotton as the cotton fibers become very flat after a little use, whereas the wool fibers stand out and remain soft and fluffy.

BATHING AND DELOUSING AMERICAN TROOPS AT BREST, FRANCE, PRIOR TO THEIR EMBARKATION FOR THE UNITED STATES

By Major LAWRENCE H. DUNN, Ovid, N. Y.
Sanitary Reserve Corps, United States Army

IN AN article which appeared in the November, 1922, issue of The Military Surgeon, the writer described the system of delousing American troops at Bordeaux, France, prior to their return to the United States. There being considerable difference in the methods of delousing work carried on at the two principal embarkation points, viz., Bordeaux and Brest, a description of this work at the latter named port is given herewith.

Practically all troops embarking at Brest were bathed, deloused and equipped for embarkation at Camp Pontanezen. This camp, located on the outskirts of Brest, had a capacity of approximately 90,000 men and was probably one of the largest military camps of modern times.

When troops entered Camp Pontanezen for embarkation to the States, the billeting officer in charge of the particular area in which they were quartered notified the detail office, located at camp headquarters, of their arrival, giving the strength of the command, number of companies, number of officers, etc. The detail officer then issued orders for this command to report at the equipment plant, in detachments of certain numbers and each to appear at a time specified in the orders, for bathing, delousing and clothing exchange.

The equipment plant consisted of Bath House No. 1, a steam laundry and a clothing issue warehouse. These buildings with quarters for many of the men on duty at the plant and quarters and a mess for the officers detailed on this work were all located in an area, in the center of the camp, known as the equipment plant area. Two other bath houses, Nos. 2 and 3, were also a part of this plant, but were at some distance in other parts of the camp.

If a regiment or division to be bathed and deloused strictly complied with orders received from the detail officer, it arrived at the plant in detachments of 167 men each at ten-minute intervals. All officers were required to accompany their men, and any detachments arriving without commissioned officers in charge were immediately turned back.

When troops arrived at the equipment plant area they entered on a board walk having a roof over it which extended from the main street of the camp to the bath house. The men marched up this walk in a column of twos, it being wide enough for two columns of twos to pass

without crowding. When the head of the column arrived at a small open shed at the side of the walk opposite the bath house it was halted, and the officer in charge of the detachment reported to the chief guide, a commissioned officer, the number of men present and the organization to which they belonged. Each morning the chief guide was furnished with a schedule of all the detachments ordered to appear at the plant for the day and the time of arrival of each, this being supplied by the detail office. If the detachment reporting was listed on this schedule, a record was made of the time of their arrival, number of men, organization, etc. All officers with the detachment were ordered to fall out and receive instructions from the chief guide while the men were sent forward under the charge of another guide.

The officers were then instructed in regard to the exchange of the men's clothing, their behavior while in the bath house and the necessity of ascertaining from the medical officers on duty all information concerning any men infested with vermin, or having skin, venereal or other diseases. The supply officer of the detachment then secured clothing slips from the office of the plant and signed a blank requisition for the exchanges.

Meanwhile the guide had led the men up the walk, around the office building and back onto a broad, wooden roadway. Here they were joined by their officers who, following the instructions received, ordered all men having clothing to exchange to fall out at one side of the roadway and those having no exchanges to form in double file and march into the bath house. Those having exchanges to make received clothing slips; each man writing his name and organization on his slip and checking from the printed list of articles those that he needed to exchange.

After all slips were properly marked and checked the men advanced to the inspection room. Five doors admitted them into this room, there being an inspector seated at each door who examined the slip of each man as he entered and checked with colored pencil the articles that the man had marked for exchange and which the inspector upon examination considered unserviceable. Garments that appeared serviceable were not O.K.'d on the slip by the inspectors, and new ones could not be drawn in place of them.

After all slips were checked by the inspectors the men passed between two railings leading to a passageway opening into the bath house. All slickers and shelter halves to be discarded were thrown over the railing on the left-hand side in a pile as the men passed along, all other articles being worn into the bath house. When entering the bath house

they passed down an aisle on the right-hand side where guides directed each man to his proper place on the seats.

The seats were arranged in rows extending across the bath house with an aisle dividing them down the middle of the room, each seat having a capacity of twenty men in a single row or forty in a double row and being arranged back to back, so that every two rows of men faced each other. The bath house had a seating capacity of 480 men, exclusive of several rows of seats that were isolated near the center of the room. These centrally located seats were for the purpose of separating the men on whom vermin were found and cases to be sent to the hospital or segregation camp.

As the men filed into the seats they were told to undress as speedily as possible. While doing this they were instructed in regard to the necessity of keeping absolutely quiet while in the bath house and in the disposal of the clothing to be salvaged. After removing all clothing but their undershirts the men stood up on the seats. Medical inspectors then passed down in front of each row of men and examined them for venereal diseases, *Pediculi* or nits on the pubic regions and lower parts of the body, and for skin diseases. Upon reaching the end of a row the inspector then instructed the men to step down from the seats and pull their undershirts over their heads and stretch them inside out over their arms. They then stood with the shirts extended over their arms while the inspector again passed in front of the row, this time examining the shirts and upper parts of the body for indications of *Pediculi* or skin diseases. All men found to be infested, or infected, were immediately taken with all their clothing to the isolation seats in the center of the room.

Those found to be free from *Pediculi* or diseases left their seats and in single file passed down the left-hand aisle, along which a number of large wooden bins were located. After throwing all underwear and unserviceable garments into these bins the men then entered the bath room.

There were 120 shower heads in the bath room, and as the men were counted in groups of 120 at a time, one group entering as soon as the preceding one left, there was always a shower head for each man. As soon as the men were under the shower heads the water was turned on for a few seconds to allow them to wet themselves thoroughly, then being turned off and instructions given to open the soap boxes and soap themselves well. The soap was semiliquid, with a small amount of kerosene added, and placed in long, shallow containers extending across the room between each two rows of showers. From one to two minutes

was the time allowed for soaping, the soap boxes then being closed and the water turned on again.

As soon as the bathing was completed the water was again shut off and the men passed into the drying room, where they received clean towels. There were four doors leading from this drying room, each one opening near a counter, from which clean underwear and socks were issued to the men as they filed past. They then returned to their seats, still carrying their towels with them for the purpose of wiping off their feet before putting on the clean socks. Here they proceeded to dress as rapidly as possible.

After putting on underwear, socks, shoes and all clothing that they had not discarded for exchange, the men passed out of the bath house through an exit door. Guides stationed at this exit directed all those needing clothing exchanged to a long, covered passageway leading to the clothing issue warehouse, while those having no exchanges to make were sent outside to go back to their barracks without returning in formation.

As the men emerged from the covered passageway into the issue warehouse, guides directed them to the issue counters. Aisles extended down each side of this room in front of long counters from which the clothing was issued. The stock from which these issues were made was stored in separate bins or compartments, built shelf-like one above the other, just back of the counters, and was replenished as needed from the main stock kept on the second floor. The back of these compartments opened on a second or inner row of counters, enclosing a large open space in the center of the building, which was used as a dressing room. As a man passed along the counter he received each article checked on his slip, so that by the time he had reached the end he was fully equipped with everything needed from toothpaste to shelter-half, provided it was all checked on his slip.

After receiving their issues the men went around to the dressing room in the center of the building. Here they could finish dressing themselves and have an opportunity to exchange all garments that did not fit satisfactorily at the counters in the dressing room. They then passed out through large doors at the back of the building and returned to their barracks.

This warehouse was probably better arranged for issuing equipment to large numbers of men than any other in operation by the American Expeditionary Forces in France. From 10,000 to 25,000 could be equipped in this building daily, the number depending entirely on the number of hours worked. A supply of goods sufficient to equip from 45,000 to 50,000 men was usually kept in stock, being replenished

from day to day as the issues made inroads on it. A railroad extended through the middle of this building, and the carloads of stock received were backed in and unloaded at night time.

The bath-house building was equipped for disinfesting the discarded clothing. A battery of twenty-one disinfestors and sterilizers was arranged in a row at one side of the building and extending the length of it. These were all supplied with steam from a large boiler located in an adjacent building. Seventeen of these were disinfestors of the English "Thresh" type, and four were sterilizers of the American "Troy" type. All the underwear, discarded outer clothing, blankets, etc., were disinfested in these machines with steam under pressure for thirty minutes. A steam pressure of 8 pounds was usually maintained in the "Thresh" machines and 15 pounds in those of the "Troy" type. After being exposed to the steam for thirty minutes the clothing was removed from the disinfestors and all discarded garments loaded on railway cars which ran into the building, to be sent to the camp salvage plant. Blankets were stacked near the large doors to be loaded on motor trucks and returned to the various billeting areas in the camp, and the underwear was loaded in small cars that had high racks built on them, running on narrow-gauge tracks from the disinfesting department to the laundry. At the laundry these cars were pushed up on a trestle so that the clothing could be removed from the racks and dropped in the top of the soiled clothes bin, which was about 10 feet high. This bin was divided by partitions so that it contained a separate section for each class of articles—towels in one section, undershirts in a second, underdrawers in a third, etc. Doors opening at the bottom of the bin near the floor allowed the clothes to be removed in the laundry and loaded on small, wheeled trucks to be conveyed to the washing machines.

This laundry would compare very well with many of the large steam laundries in the United States, being well equipped with washers, extractors, driers and a large mangle of modern type. The work done was very good, and as high as 75,000 laundered articles were turned out in twenty-four hours. As soon as the clothing was washed, dried, etc., it was all sorted, the torn articles being taken out and sent to the salvage plant, and the serviceable goods were resized and tied in bundles (twelve garments to a bundle) and then returned to the bath house for reissue. All towels were passed through the mangle and sent to the bath house clean and ironed smoothly. For several months during the spring and early summer of 1919 this laundry was in operation day and night.

Men found to be infested with *Pediculi* at Bath House No. 1 were sent with all their equipment to Bath House No. 3 to be deloused. There they were again examined by medical officers, and all parts of the

body where nits were found attached to the body hairs were closely shaven and a mixture of kerosene and cottonseed oil applied, after which a warm bath was taken.

All their clothing and blankets were well disinfested and returned to them. They were then allowed to go back to their organizations.

Bath House No. 3 was considerably smaller than No. 1, having a capacity of from 400 to 500 men an hour. It was arranged on a very good plan, having a disrobing room on the entrance side where the men undressed and passed into the bath room. After bathing they entered a small issue room where they received clean underwear and socks and then emerged into the dressing room. A row of seven "Thresh" disinfestors extended down through the middle of the building and separated the disrobing room from the dressing room. Long counters extended on each side of this row of disinfestors. As the men undressed they placed their garments in wire baskets on the counter at the disrobing side, this being used only for articles that had not been disinfested. After being placed in the disinfestors and exposed to steam for thirty minutes these garments were removed through doors at the ends opposite from which they were put in, and placed on the counter at the clean or dressing side, where the men secured them when they returned from the bath room. As the clothes were tied in bundles with the metal identification tags of the owners attached there was but little difficulty in each man securing his own clothes. A boiler maintaining 50 pounds of steam pressure supplied the steam necessary to operate these seven disinfestors.

Bath House No. 2 was located at the opposite end of the camp from No. 3 and was used for bathing purposes only, having no disinfestors installed for delousing. This plant had a capacity of 100 men an hour and provided facilities for bathing many of the transient and permanent troops located at that end of the camp.

One may readily perceive from the foregoing that the system of delousing at Camp Pontanezen was not as perfect as might be desired, this lack of perfection being due to several reasons.

A large delousing plant, built somewhat after the plan of the Bordeaux "Mill" and using hot air as a delousing agent, after having been in operation at Pontanezen for several months was destroyed by fire early in 1919. The troops were returning to the United States in large numbers at this time, and haste was therefore necessary in constructing a plant to replace the one burnt down.

The new plant, Bath House No. 1, was built with apparently but little understanding of its possibilities or impossibilities as a delousing plant. The disinfestors were placed at one side of the building, leaving

the disrobing and dressing to be done in the same large room, whereas, had the disinfestors been installed in a row through the middle of the building, the space would have been divided and this would have permitted a disrobing room on one side and a dressing room on the other. This arrangement would also have facilitated the disinfesting of garments and returning them to the men, although the disinfesting capacity provided would have been inadequate to handle the garments of the great number of men that went through this bath house during the spring and summer of 1919.

As it was, the disinfesting of all garments was not carried out and the presence of lice was not considered unless found by the medical officers during the inspections of the men and part of their underclothing. While without a doubt the majority of these inspections were conscientiously performed, it is quite probable that on very busy days, when each inspector had many examinations to make, some of them were made too hastily to be very effective.

If a man having a light infestation passed the medical inspection without detection, he could take his bath, receive clean underwear and socks, return to dress on the same seat where he had undressed, put on his O. D. shirt or other outer garments which had not been disinfested and which possibly might have nits or lice attached, draw any exchanges necessary at the warehouse and return to his quarters still infested. In the course of a few days he would possibly be as badly infested as he was previously. While this probably happened but very rarely, if at all, the possibilities existed.

Another important flaw in the system was the failure to keep the men strictly confined to camp. Many of them visited the city of Brest while waiting to embark, with the chances of becoming infested or reinfested there.

In defense of these shortcomings in the delousing work it may be said that the quantity of work overshadowed the quality, and that this work at Camp Pontanezen was probably conducted on a larger scale than had ever before been attempted in any part of the world. Some days the number of men to be cleaned up exceeded 12,000.

In order that an idea may be had of the magnitude of this work during the summer of 1919, it may be stated that when the writer was detailed as Officer in Charge of Bathing and Delousing and the Equipment Plant, there were approximately 1,200 men and 24 officers engaged in this operation.

ASSOCIATION NOTES

AN EVIDENCE OF APPRECIATION FROM ONE OF OUR ALLIES

The circular letter which follows was sent out from the Office of the Surgeon General of the Army to evidence the appreciation of courtesies extended to the Medical Officers representing France at the annual meeting of the Association in Washington in October:

CIRCULAR LETTER NO. ———

Subject: French visitors, Annual Meeting of the Association of Military Surgeons of the United States.

1. The following letters are brought to the notice of the officers of the Medical Department:

FROM THE MINISTER OF WAR, FRENCH REPUBLIC

FRENCH REPUBLIC
MINISTRY OF WAR

PARIS, *December* 18, 1922.

MR. MAJOR GENERAL:

I was particularly touched by the very warm welcome which was extended by the Army Medical Corps of the United States to the French army surgeons, Messrs. Rouvillois and Picqué, on the occasion of the annual meeting of the Association of Military Surgeons of the United States.

I am happy to address to you personally my sincere thanks and would ask that you be good enough to transmit them to your service.

I can assure you that the French Army Medical Corps has had great satisfaction in seeing renewed in such a friendly form the scientific relations commenced before the war with the Health Service of the United States.

Kindly accept, Mr. Major General, the assurances of my high regard.

(Signed) MAGINOT.

Major General Ireland
Surgeon General of the U. S. Army,
Washington.

THE SURGEON GENERAL'S REPLY

February 2, 1923.

MR. MINISTER:

I have the honor to acknowledge the receipt, through diplomatic channels, of your favor of December 18 last, expressing your thanks for the welcome extended by the Medical Corps of the United States Army to the French army surgeons, Messrs. Rouvillois and Picqué, on the occasion of the recent annual meeting of the Association of Military Surgeons of the United States, and in behalf of that corps to

indicate its reciprocation of your friendly sentiments. I have caused your letter to be brought to the attention of the officers of my service.

With renewed assurances of my great esteem, I am

Most sincerely yours,

M. W. Ireland,
Surgeon General, U. S. Army.

Mr. Maginot,
Minister of War,
Republic of France.
Through the Military Attaché,
French Embassy,
Washington, D. C.

By order of the Surgeon General:

C. R. Reynolds,
Lieut. Colonel, Medical Corps,
Executive Officer.

COMMENT AND CRITICISM

SCOPE OF SURGERY AT THE FRONT[1]

It is, I think, a conceded fact that we are unanimous in the belief that the function of the Medical Corps in the front area is to clear the battlefield of the wounded and to save the lives of the wounded. The clearing of the battlefield must be accomplished without interfering with the battle. If this cannot be done, then life must be sacrificed.

At the present time the Ambulance Section of the old organization is divided into the Sanitary Battalion and the Ambulance Battalion, leaving the Field Hospital Section to become the Field Hospital Battalion. These, with such detachments as Veterinary, Supply, etc., make up the new Medical Regiment.

The Sanitary Battalion takes charge of the forward dressing station. At this point anti-tetanus serum should be given and the patient so marked, hemorrhage should be controlled, protective dressing applied, and the Thomas splint put on where necessary. Those without abdominal wounds may be given hot drinks or light food.

Then the ambulance company transports the patients to the field hospital or triage. Here records are made out, anti-tetanus serum records checked up and, if none has been given, it is now done, wounds are examined for bleeding, dressings and splints adjusted or re-applied. Those who are in shock or for other causes need a rest before going farther to the rear are sent to the non-transportable ward. It is in this ward that the question must be decided as to what, if any, surgery should be done. If a blood vessel is in such a position that the snug dressing will not control the bleeding, then it must be exposed and ligated. Those who are in shock must receive artificial heat and, when indicated, a blood transfusion or physiologic salt solution, either intravenously or hypodermically together with rest.

The 132d F. H., while on the Verdun and Troyon fronts, had some 9,000 patients go through. It also received all the non-transportable cases of the 33rd Division and many of the 29th Division during the Meuse-Argonne offensive. We were supplied with an excellent surgeon and a smoothly running personnel, and yet I cannot but feel that any major surgery or any surgery other than that mentioned above, the patient would have been just as well, if not better, off by having it postponed until he reached the evacuation hospital some 12 miles in the rear. They can just as well be given the rest, heat, stimulation and hydration where needed.

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[1] Read at meeting of The Association of Military Surgeons of Illinois, November 20, 1922.

Remember that the field hospital must be kept a mobile institution, and this is very difficult if you have it filled with patients recently operated upon.

I consider a good shock team at this point of infinitely greater value in saving lives than an operating unit. Most of the cases, after having gone through the hands of the shock team, will stand very nicely the extra journey to the evacuation hospital.

These conclusions are based on ideal working conditions. Our hospital was in such a good position with such good working surroundings that it was taken over by an evacuation hospital when we were compelled to move on account of the advance. Certainly under less favorable conditions major surgery would be less feasible.

James J. McKinley,
Lieut. Col., M. C., Ill. N. G.

THE MEDICAL RESERVE CORPS

WAR DEPARTMENT
OFFICE OF THE SURGEON GENERAL
WASHINGTON

January 12, 1923.

The following list of hospitals and other units of the Organized Reserves is handed you with the idea that it be published in the Military Surgeon as a news item. It might be well to remind the readers that under the military policy established by the National Defense Act of 1916, amended June 4, 1920, the War Department has proceeded with the organization of the Organized Reserves, dividing the project into two parts, the first comprising the organizations of the units, such as divisions under Corps Area control, and secondly, the organization of units under War Department control. In the latter category there fall many medical units, such as general hospitals, evacuation hospitals, surgical hospitals, laboratory units, supply units, air service units, veterinary units, etc., which in a national emergency would serve the three components of the Army of the United States, namely, the Regular Army, the National Guard, and the Organized Reserves. The problem placed before the Surgeon General is an enormous one. The point should be stressed, I believe, that the first two echelons of our defense—namely, the Regular Army and the National Guard—are composed chiefly of combat units functioning in the divisional zone without hospitalization facilities back of the division. This hospitalization must be organized and furnished therefore by the third component, namely, the Organized Reserves.

The following list of hospitals and other medical units of the Organized Reserves represents the progress made by the Surgeon General.

C. R. Reynolds,
Lieut. Colonel, Medical Corps, U. S. Army.

The Surgeon General has authorized the following units of the Organized Reserves on the dates shown:

First Army Medical H.Q.S.	Second Corps Area	Sept. 8, 1922
Surgical Hospital No. 6	Peter Bent Brigham Hospital Unit, Boston, Mass.	Nov. 9, 1922
Surgical Hospital No. 15	Italian Benevolent Institute and Hospital Unit, New York City	July 8, 1922
Surgical Hospital No. 16	Southern Pacific Hospital Unit, Houston, Texas	Dec. 5, 1922
Evacuation Hospital No. 18	Methodist Episcopal Hospital Unit, Indianapolis, Ind.	Nov. 18, 1922
Evacuation Hospital No. 19	Davis-Fischer Sanitarium Unit, Atlanta, Ga.	Nov. 25, 1922
Evacuation Hospital No. 20	Flower Hospital Unit, New York City	July 5, 1922
Evacuation Hospital No. 21	St. Anthony's Hospital Unit, Terre Haute, Ind.	Aug. 1, 1922
General Hospital No. 6	Massachusetts General Hospital Unit, Boston, Mass.	July 5, 1922
General Hospital No. 10	Pennsylvania Hospital Unit, Philadelphia, Pa.	Dec. 2, 1922
General Hospital No. 21	Washington University School of Medicine Unit, St. Louis, Mo.	June 30, 1922
General Hospital No. 25	University of Cincinnati College and Cincinnati General Hospital Unit, Cincinnati, Ohio	Aug. 15, 1922
General Hospital No. 26	University of Minnesota and University Hospital Unit, Minneapolis, Minn.	Nov. 10, 1922
General Hospital No. 43	Emory University Unit, Emory University, Ga.	Aug. 15, 1922
General Hospital No. 46	University of Oregon Medical School Unit, Portland, Oregon	Nov. 6, 1922
General Hospital No. 48	Metropolitan Hospital Unit, Welfare Island, New York City	July 5, 1922
General Hospital No. 50	University of Washington Unit, Seattle, Wash.	Nov. 9, 1922
General Hospital No. 51	Georgetown University School of Medicine Unit, Washington, D.C.	July 3, 1922
General Hospital No. 52	Syracuse University School of Medicine Unit, Syracuse, N. Y.	July 6, 1922
General Hospital No. 53	St. Louis University School of Medicine Unit, St. Louis, Mo.	July 8, 1922
General Hospital No. 54	State University of Iowa College of Medicine Unit, Iowa City, Ia.	July 8, 1922

General Hospital No. 55	Creighton University College of Medicine Unit, Omaha, Neb.	Aug. 1, 1922
General Hospital No. 56	University of Oklahoma, School of Medicine Unit, Oklahoma City, Oklahoma	Aug. 15, 1922
General Hospital No. 60	Iowa Methodist Hospital Unit, Des Moines, Iowa	Aug. 18, 1922
Station Hospital No. 1	Connecticut State Unit	Sept. 13, 1922
Station Hospital No. 2	Cook County, Ill., Unit	Sept. 22, 1922
Station Hospital No. 4	Indiana State Unit	Sept. 15, 1922
Station Hospital No. 5	Minnesota State Unit	Sept. 27, 1922
Station Hospital No. 6	Michigan State Unit	Sept. 26, 1922
Hospital Center H.Q.S. "A"	New York City Unit	Sept. 28, 1922
Convalescent Camp No. 1	Maryland State Unit	Oct. 13, 1922
Convalescent Camp No. 2	Virginia State Unit	Oct. 13, 1922
Hospital Train No. 1	Ninth Corps Area	Oct. 13, 1922
Hospital Train No. 3	Third Corps Area	Oct. 13, 1922
Hospital Train No. 4	Fourth Corps Area	Oct. 13, 1922
Hospital Train No. 6	Seventh Corps Area	Oct. 13, 1922
Hospital Train No. 7	Eighth Corps Area	Oct. 13, 1922
Hospital Train No. 8	Second Corps Area	Oct. 13, 1922
Hospital Train No. 9	Third Corps Area	Oct. 13, 1922
Hospital Train No. 10	Sixth Corps Area	Oct. 13, 1922
Hospital Train No. 11	Third Corps Area	Oct. 13, 1922
Hospital Train No. 17	Second Corps Area	Oct. 13, 1922
Hospital Train No. 18	First Corps Area	Oct. 13, 1922
Hospital Train No. 26	Second Corps Area	Oct. 13, 1922
Hospital Train No. 28	Fifth Corps Area	Oct. 13, 1922
Hospital Train No. 40	Second Corps Area	Oct. 13, 1922
Hospital Train No. 44	Ninth Corps Area	Oct. 13, 1922
Hospital Train No. 46	Sixth Corps Area	Nov. 25, 1922
Hospital Train No. 48	Eighth Corps Area	Oct. 13, 1922
Hospital Train No. 54	Fifth Corps Area	Oct. 13, 1922
Hospital Train No. 56	Fourth Corps Area	Oct. 13, 1922
Hospital Train No. 60	Seventh Corps Area	Oct. 13, 1922
Hospital Train No. 62	Fifth Corps Area	Oct. 13, 1922
Hospital Train No. 63	Seventh Corps Area	Oct. 13, 1922
Hospital Train No. 64	Fourth Corps Area	Oct. 13, 1922
Hospital Train No. 66	Seventh Corps Area	Oct. 13, 1922
Hospital Train No. 67	Sixth Corps Area	Oct. 13, 1922
Hospital Train No. 68	Fifth Corps Area	Oct. 13, 1922
Hospital Train No. 70	Third Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 2	Ninth Corps Area	Oct. 4, 1922
Aviation Physical Examining Unit No. 4	Eighth Corps Area	Oct. 4, 1922
Aviation Physical Examining Unit No. 5	Ninth Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 6	Second Corps Area	Oct. 13, 1922

Aviation Physical Examining Unit No. 7	Fourth Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 8	Fifth Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 9	Second Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 10	Seventh Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 12	Third Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 13	Fifth Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 14	Fourth Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 15	Third Corps Area	Oct. 13, 1922
Aviation Physical Examining Unit No. 16	Third Corps Area	Oct. 13, 1922
Army Medical Laboratory No. 5	New York State Unit	Oct. 13, 1922
Army Medical Laboratory No. 6	Sixth Corps Area	Oct. 17, 1922
Hospital Center Laboratory No. "B"	Pennsylvania State Unit	Sept. 28, 1922
General Medical Laboratory No. 1	Slee Laboratories, Swiftwater, Pa.	Sept. 7, 1922
Army Medical Supply Depot No. 16	Fourth Corps Area	Oct. 12, 1922
Army Medical Supply Depot No. 17	Eighth Corps Area	Oct. 12, 1922
Army Medical Supply Depot No. 18	Eighth Corps Area	Oct. 12, 1922
Base Medical Supply Depot No. 1	New York State Unit	Oct. 12, 1922
Base Medical Supply Depot No. 2	Fourth Corps Area	Oct. 12, 1922
Base Medical Supply Depot No. 3	Illinois State Unit	Oct. 13, 1922
Base Medical Supply Depot No. 4	New York State Unit	Oct. 12, 1922
Base Medical Supply Depot No. 5	Iowa State Unit	Oct. 13, 1922
Veterinary General Hospital No. 1	University of Pa., School of Veterinary Medicine Unit, Philadelphia	Nov. 9, 1922
Veterinary General Hospital No. 2	Fifth Corps Area	Dec. 5, 1922
Veterinary Evacuation Hospital No. 1	Ninth Corps Area	Dec. 11, 1922
Veterinary Evacuation Hospital No. 2	Ninth Corps Area	Dec. 11, 1922
Veterinary Evacuation Hospital No. 5	Fifth Corps Area	Dec. 6, 1922
Veterinary Evacuation Hospital No. 6	Sixth Corps Area	Dec. 6, 1922
Veterinary Station Hospital No. 4	Seventh Corps Area	Nov. 29, 1922
Veterinary Station Hospital No. 5	Seventh Corps Area	Dec. 6, 1922
Veterinary Convalescent Hospital No. 3	Sixth Corps Area	Dec. 14, 1922

"IT SOUNDS GOOD TO US"

EIGHT AMERICAN SOLDIERS

By Samuel McCoy

The heroism of the eight Americans whom I am about to name was duplicated in every one of the hundreds of regiments which were sent from America to serve in France; I name these eight men merely because their war records happen to be before me at the moment, and because much has been said of late in regard to the proper qualifications for American citizenship.

Each of these men was awarded the Distinguished Service Cross. Twenty thousand men who fought in the same division to which they belonged all acquitted themselves with honor in the face of danger. A thousand men of the division were singled out to appear in the divisional citations for feats of heroism performed in that campaign. But these eight were ranked even higher than all these. They were of the handful who won the Distinguished Service Cross—a decoration awarded only "for *extraordinary* heroism in action."

The first man, a sergeant, in the assault launched against the seemingly impregnable Hindenburg Line, "although twice wounded, refused to leave the field, but remained with his platoon, exhibiting magnificent courage and bravery, until he was wounded a third time. His devotion to duty set a splendid example to the men of his company."

The second, a corporal, in the same fearful fire from the enemy, "was an advanced scout for his platoon. The platoon was temporarily halted by machine-gun fire from a section of the enemy trench in their immediate front. He rushed through the heavy enemy fire to the trench, and at the point of his rifle compelled twelve of the enemy to surrender. He then signaled for the platoon to advance."

The third, also a corporal, "left shelter, went forward under intense machine-gun fire, and carried a wounded officer to a place of safety. In accomplishing this mission he was severely wounded."

The fourth man, a private, first-class, "when the advance of his battalion was checked by heavy machine-gun fire, went forward, with two other soldiers, under heavy fire to reconnoiter the enemy positions. By effective rifle fire they drove the gunners from two machine-gun nests into a dugout near by, which they captured, together with thirty-five prisoners, including three officers."

The fifth man, also a private, "after being severely wounded by flying shrapnel, took shelter in a shell hole somewhat in advance of his company, from which he had become separated in the fog and smoke. He saved the lives of four of his wounded comrades who were occupying

the shell hole, by throwing live grenades, which had been tossed into the shell hole by members of his own company in the rear, into the enemy's lines."

The sixth, a private, "under heavy shell and machine-gun fire, left the shelter of his trench, and, going forward under a thick smoke screen, single-handed captured between thirty and forty prisoners. . . . Three weeks later, in a second battle, after the advance of his company had been stopped by strong hostile machine-gun fire, he, with three companions, advanced far ahead of the front line to attack an enemy position located in a large farmhouse. By skillful maneuvering in the broad daylight, they covered all entrances to the house and forced the surrender of the entire force of the enemy, numbering thirty-six men and two officers. During the exploit they killed two of the enemy who attempted to take cover in the cellar."

The seventh, a private, "exhibited exceptional bravery by leaving shelter and going out into an open field under heavy machine-gun and shell fire to rescue wounded soldiers."

The eighth man, also a private, "while the advance against the Hindenburg Line was at its height, seeing an American machine gunner exposed to the enemy, ran to his assistance. On the way he was seriously wounded, but continued on, reaching the position and using his body to shield the gunner while the latter poured a fire into the enemy. He was wounded three times, finally losing consciousness, but after his wounds were dressed he insisted on leaving the field unaided."

The names of these eight American soldiers, all of whom are still living, are:

John N. F. Bilitzki, Lonnie J. Moscow, Aloizy Nagowski, Isaac Rabinowitz, Epifanio Affatato, Wasyl Kolonoczyk, Daniel Moskowitz, and Antony Sclafoni.—*From Collier's.*

THE DOCTOR SOFIE A. NORDHOFF-JUNG CANCER RESEARCH PRIZE

Dr. Sofie A. Nordhoff-Jung of Washington, District of Columbia, United States of America, has founded an annual prize of $500 bearing the title of "The Sofie A. Nordhoff-Jung Cancer Research Prize." This prize is destined for the encouragement of researches in the etiology, prevention and treatment of cancer. It will be awarded by a commission, composed of members of the University of Munich, Bavaria, and be granted for the first time in December of the year nineteen hundred and twenty-three. The commission consists of Professors Borst, Doederlein and Sauerbruch, with Professor von Romberg as chairman. This body is empowered to elect successors. The award will be made

as a recognition of the most conspicuous work in the world literature bearing on cancer research, done at a time antecedent to the allotment of the award. Though the prize will not be awarded on a competitive basis, the commission invites all research workers in cancer to submit literature on this subject.

Dr. Leroy Crummer, Professor of Clinical Medicine, Medical College of Omaha (University of Nebraska), will lecture before the Army Medical School, Wednesday, March 28, 1923, from 1 to 2 p. m. on "Fugitive Medical Sheets."

BOOK REVIEWS

General and Professional Biology, with Special Reference to Man (a one or two-year course, including introductory embryology and comparative anatomy), by Edward J. Menge, Ph.D., Director of the Department of Zoölogy, Marquette University; Late Professor of Biology, University of Dallas. 8°, 959 pp. Milwaukee: The Bruce Publishing Company, 1922.

Biology in its broadest interpretation deals with all the phenomena manifested by living matter. Customarily and conveniently certain groups of these phenomena are set apart from other groups and are investigated by themselves. Thus the mental phenomena of man and animals are included in that subdivision of biology known as psychology, which is itself in turn appropriately subdivided. Human activities exhibited in that state which we know as organized society are treated of in sociology. Yet it cannot be claimed that any natural boundary distinctly separates the matters with which these two sciences concern themselves from those of biology in general; for psychology is indissolubly bound up with physiology, and among animals there are observed phases of a social life which often parallel and curiously foreshadow the social relationships of human groups. Certainly physiology and animal sociology come very strictly within the field of the biologist's studies.

On the other hand, biology is sharply delimited from those sciences which deal with the phenomena exhibited by lifeless matter, at least to the extent that the properties of living matter distinguish it absolutely from all other things. Human knowledge has as yet furnished us no connecting link between the living and the non-living.

All tissues endowed with life, whether animal or vegetable, have three distinctive properties:

1. *Chemical composition.* The elements carbon, oxygen, hydrogen, and nitrogen invariably enter into the make-up of the proteins—substances which have never yet been obtained other than as products of life processes, and without which life cannot exist. These proteins, together with a large proportion of water, are the fundamental constituents of a primordial substance called "protoplasm."

2. *Metabolism.* Protoplasm is constantly being synthesized through the process of anabolism and is as constantly being decomposed by oxidation into the less complex products which cease to form an integral part of the living organism. This metabolism is a constant feature of all life. Of the waste products resulting from catabolism one of the most important is carbon dioxide, while the others contain the remaining carbon, the hydrogen, the nitrogen, and the other elements present in protoplasm in minute amounts.

3. *Cyclical changes.* All living matter is derived from preëxisting life. In one way or another a portion of the parent organism becomes detached and acquires an independent existence. The offspring partakes in general of the characteristics of the parent. Thus it possesses the power, among others, of propagating itself; and sooner or later it ceases to exist as a living entity and is resolved through the process of oxidation into simpler and lifeless substances.

In summary, then, every individual living being is continually changing its protoplasm, and is likewise experiencing constant modifications of size and form; and the ultimate end of all this is the death and decay of the particular individual. No lifeless matter possesses all three of these foregoing properties, nor in fact does such material ever manifest any phenomena that approach those described under the second and third headings. While these three are the most important of the characteristics of all life, they are not the only

ones. Thus, life is conditioned upon moisture and temperature. In most living beings that optic heterogeneity which renders visible all animals and plants large enough to be seen by the human eye, aided or unaided, is resolved into or exchanged for a definite structure, by whose virtue it may be observed that the body consists of different parts possessing different powers and functions. All individuals possessed of such structure are referred to as "organized"; but to such an extent does this organized condition obtain among living entities that the words "organized" and "living" are frequently used as if they were essentially synonymous. To attribute to these two terms a "coextensive applicability" is not, however, entirely accurate, if thereby it be implied that all living things are endowed with a visible structure and organization, since there are certain forms endowed with life which cannot properly be said to have a definite structure or permanently specialized organs.

Protoplasm may be looked upon from four points of view: (1) It has a certain definite external and internal arrangement. The latter is known as "structure." (2) It occupies a determined position in space and time. (3) It is subject to the operation of certain natural forces by virtue of which its internal arrangement is modified, and which cause it to modify other external objects and to be externally modified by them. (4) Its form, its position, and its functions are the results of certain determinative causes.

Taking into account these four points of view, we may reasonably subdivide biology into: (*a*) Morphology; (*b*) Distribution; (*c*) Physiology; (*d*) Causation. Broadly speaking, these four subdivisions should constitute the major topics of biological study. It is a fact, however, that the actual apportionment of scientific labor as it exists today in the civilized world does not correspond to these logical subdivisions of the general science. A certain confusion, if so it may be called, has resulted therefrom, and many other more-or-less strictly defined subdivisions of this subject have been developed.

Aristotle (384–322 B.C.), the pupil of Plato, is shown in the chapter on "The History of Biology" in Dr. Menge's book, to have been one of the earliest men to conceive of botany and zoology as definite realms for scientific investigation. The world owes to him the so-called "law of continuity" which establishes the principle that "nature works by definite fixed laws." Theophrastus (370–286 B.C.), Hippocrates (460–370 B.C.), Dioscorides (64 A.D.), Galen (131–201 A.D.), and Pliny the Elder (23–79 A.D.) were the only writers on biology, previous to the time when Christianity began to make itself a force in the world, of whom there is any record extant. To Roger Bacon (1214–1294) is ascribed the honor of being "the real father of modern science." Following him a brilliant list of names includes Vesalius, Gessner, Fallopius, Harvey, Severinus, Boyle, Malpighi, Van Leeuwenhoek, Robert Hooke, Peyer, Reaumur, Haller, John Hunter, Darwin, Priestley, Wolff, Lavoisier, Linnæus, Lamarck, Cuvier, Johannes Müller, Owen, Huxley, Aggassiz, Bichat, Magendie, von Baer, Liebig, Schwann, Helmholtz, Francis Galton, Mendel, Pasteur and many others.

The author gives a "chronological table of important biological events," which presents so interesting a bird's-eye view of the whole evolution of this science that it is quoted in full:

B.C.

540 Xenophanes: first to recognize fossils as proving that the earth was formed under the sea and rose out of it.
500 Heraclitus: often called the first evolutionist; he first advanced the principle that "all things flow."
450 Empedocles: first to suggest natural selection and survival of the fittest.
400 Hippocrates: called "the Father of Medicine."
350 Aristotle: founder of zoölogy.
320 Theophrastus: first botanist.
320 Erasistratus: first to give mechanical explanation of disease symptoms.

300 Herophilus: first anatomist.
A.D.
79 Pliny: wrote first popular natural history.
160 Galen: founded medical physiology.
1266 Bacon: wrote his Opus Majus.
1542 Vesalius: founder of modern anatomy.
1548 Falloppio: anatomist.
1551 Gesner: gathered first botanical garden (of fruits and flowers) and first zoölogical museum.
1560 Eustachio: anatomist.
1583 Caesalpinus: classified plants by flowers.
1590 Janssen, J. and Z.: discovered compound microscope.
1603 Harvey: discovered circulation of the blood.
1622 Ascello: discovered the lacteals.
1649 Rudbeck: discovered the lymphatics.
1650 Swammerdam: first great student of insects in relation to plants and medicine.
1661 Malpighi: founder of pathology; discovered the capillaries in the lungs; founded modern embryology by a study of the incubation of the chick (1672).
1667 Leeuwenhoek: first to see bacteria.
1668 Redi: disproved spontaneous generation of insects by the discovery of eggs and larvae; wrote "Esperienze intorno alla Generazione degl' Insetti."
1670 Mayow: studied animal respiration.
1671 Hooke: worked out microscopical structure of plants.
1680 Borelli: proved that all the movements of animals are caused by muscles pulling on bone levers; wrote "De Motu Animalium."
1682 Grew: studied structure of plants.
1693 Ray: classified plants.
1727 Hales: investigated respiration of plants.
1743 Haller: father of modern physiology.
1744 Reaumur: studied insects.
1749 Buffon: wrote a natural history.
1753 Linnaeus: founder of modern botany; classified plants.
1761 Koelreuter: studied hybridization of plants.
1764 Bonnet: evolutionist; grouped animals in an ascending series.
1764 Wolff, Friedrich, Caspar: overcame the preformation doctrine.
1772 Rutherford: discovered nitrogen.
1774 Priestley: discovered oxygen and studied the breathing of plants.
1775 Spallanzani: disproved spontaneous generation of bacteria and molds and demonstrated presence of living germs in the air.
1789 Galvani: discovered animal electricity.
1790 Goethe: worked out a scheme for the metamorphosis of the parts of plants.
1794 Darwin, Erasmus: grandfather of Charles Darwin; wrote "Zoonomia," a long poem outlining evolution of life.
1796 Jenner: discovered vaccination.
1796 Sprengel: studied fertilization of plants.
1800 Cuvier: founder of modern comparative anatomy; wrote "Le Regne animal," 1917.
1800 Bichat: founder of modern histology.
1801 Lamarck: invented a scheme for the evolution of animals (by conscious effort and inheritance of acquired characters; not proved).
1801 Treviranus: introduced the name "Biology" as distinguished from "Botany," "Zoölogy," "Physiology," "Anatomy," etc.
1804 Humboldt: studied distribution of plants.
1807 Rumford, Count: demonstrated absorption of carbonic acid by plants.
1811 Bell, Charles: discovered motor and sensory nerve roots; founder of modern neurology.
1818 St. Hilaire, G.: pointed out unity of plan in animals.
1823 Von Baer: discovered the law of embryological development; (all higher forms pass through somewhat similar forms to lower ones in the embryological period).
1830 Brown: described cell nucleus.
1833 Müller, Johannes: founder of modern comparative physiology. Wrote Handbuch der Physiologie des Menschen.
1835 Dujardin: studied protoplasm.
1838 Schleiden: discovered the cell as unit of structure in plants.
1838 Schwann: discovered the cell as unit of structure in animals.

1839 Agassiz: wrote on fresh-water fishes.
1841 Helmholtz: discovered rate of nerve impulse.
1853 Mohl: studied protoplasm (living substance).
1857 Pasteur: founder of bacteriology; studied fermentation.
1858 Darwin: reported his work upon the origin of species by natural selection and applied evolution to man.
1858 Wallace: reported his work upon the origin of species by natural selection.
1858 Virchow: worked out cellular pathology; founder of modern cellular pathology.
1861 Schultze, Max: established protoplasm doctrine.
1863 Huxley: wrote "Evidence as to Man's Place in Nature."
1863 Lyell: wrote "The Antiquity of Man."
1865 Sachs: studied structural botany.
1865 Mendel: founder of modern genetics; discovered the law of heredity.
1867 Lister: worked out aseptic surgery.
1875 Galton: studied inheritance.
1875 Hertwig, O.: studied fertilization.
1880 Koch: proved the relation of bacteria to disease.
1880 Laveran: discovered malarial parasite (in the mosquito).
1886 Leuckart: settled the modern classification of animals; specialized on parasites.
1893 Weismann: showed that germ-plasm and somatoplasm are distinct.
1893 Zittel: wrote most important work on fossils.
1888 Finlay
1898 Reed — Discovered relation between yellow fever and the mosquito.
1898 Lazear
1898 Howard: discovered relation between typhoid fever and the house fly.
1900 De Vries, Correns, Tschermak: all working independently, rediscovered Mendel's law of heredity.
1903 Stiles: discovered hookworm in the United States.
1914 Goddard: proved feeble-mindedness a unit character.
1915 Stockard: discovered influence of alcohol on offspring.

This book is the work of a teacher. It has all the earmarks. It recognizes and elucidates not only the problems of the subject itself, but likewise it solves the riddle with which teachers are confronted of introducing the young student to a new line of thought. A discussion of "Why to study?" and "How to study" touches upon a most vital need of those who make their earliest incursions into the field of science, especially in America. In particular, the fundamental principle of systematization is exemplified and its necessity made manifest.

Something concrete in the form of the anatomy of the frog is offered before the more refined subject of "Chemistry of Living Matter and Cell Division" is approached. The histology of a frog's tissues is then described, and with "The Protozoa" practical biology is attacked in earnest. After a chapter on "Genetics" and "Animal Psychology" certain "Intermediate Organisms" (including the bacteria) are considered, and the subject of immunity is next briefly but clearly reviewed. Several chapters deal with plants; and the Coelenterata, the Coelomata, the earthworm, the flat worms and thread worms, the Arthropoda, and the insects are then discussed before the author breaks the chain of the student's practical labors to interest him in the history of biology. After this classical diversion attention is given to paleontology and evolution. These two subjects are followed by the most complete and readily useful chapter on classification that could be set down within the brief compass of eighteen pages. Part I of the book is here concluded. Part II is taken up with the subject of elementary embryology, while Part III concerns itself similarly with comparative anatomy.

The index is much more than the usual cut-and-dried affair in that it consists of (*a*) a table of prefixes, (*b*) an index glossary with rules as to pronunciation and a key to derivations, and (*c*) the index proper in which the etymology of all words and a short dictionary definition of many words are given.

It is not too much to say that this volume marks a new departure in the teaching of

biology. In its general conception, in its sympathetic recognition of the difficulties which young minds encounter in their first contact with science, and in the historical review so largely quoted from in earlier paragraphs, the book is fascinating. It is deserving of wide acceptance as a textbook in high schools, colleges and premedical schools.

A. N. Tasker.

Within the Atom, a Popular View of Electrons and Quanta, by John Mills, Fellow, American Physical Society, Author "The Realities of Modern Science." Illustrated; second printing, revised. 12°, 215 pp. New York: D. Van Nostrand Company, 1922.

Students of science in an earlier generation were taught to look upon the molecule as the smallest subdivision of any material substance that might exist by itself, and to view the atom as the concept of those still more minute elementary particles which, aggregated together in greater or less numbers, composed the molecule. The atom was the *ultimum et minimum* of the universe and was regarded and discussed with that amount of awe which superlatives always command. But how are the mighty fallen! Another divinity's clay feet have been revealed. The indivisible has been subdivided. Now we know that the atom is composed of electrons varying greatly in numbers.

The sciences of physics and chemistry have in recent years made the most extraordinary advances in the common field of so-called physical chemistry. These advances have given wonderful aid to many of the sister sciences. Deductions based upon research in physical chemistry have led to the investigation of hitherto unsolvable problems in other fields, along lines and by methods never before thought of, with the result that phenomena otherwise unexplainable have been placed in their proper scientific niche (so far as concerns causation), and previously suspected facts have been definitely established as truth. Thus the presence of rubidium in that mass of flaming gases known as the Sun was finally given incontrovertible proof, as the ultimate result of deductions based upon knowledge acquired through the methods of physical chemistry concerning the difference in location in the spectrum of Fraunhöfer's lines produced by individual elements before and after ionization.

The study of the atom has taken on, in consequence of the new light thrown upon its structure and properties, a preponderant importance in all physics and chemistry, and a great mass of literature on the subject has come into existence. In the modern view the atom is no longer an undifferentiated elementary mass forming a constituent portion of a molecule, but is conceived of as being composed of at least two varieties of particles—one charged with negative electricity and the other positively charged. For the former the name "electron" has been almost universally accepted; for the latter no such agreement exists. John Mills, in the book here under review, refers to it as the "proton." Perhaps a more general custom is to denominate them respectively negative electrons and positive electrons. But whatever the final decision as to nomenclature may be, the atom is now held to be composed of these corpuscles variously arranged. The simplest atom—that of hydrogen—includes but one proton and one electron, described as "probably whirling about each other in space much like a rapidly whirling dumbbell except that there is no direct connection between the ends of the dumbbell." Furthermore—for the hydrogen atom—"the atomic diameter is about two hundredths of a millionth of a centimeter, but this is about one hundred times as large as that of the electron. The diameter of an electron is about two-tenths of a thousandth of a millionth of a centimeter, as the most recent investigations indicate." When, on the other hand, there is a question of more than one proton types of material structure are possible. In the simpler of these all the protons are gathered together into one compact mass (known as the "nucleus"), which also contains a sufficient number of electrons to overcome that tendency to dissociate themselves one from the other which is characteristic of the protons, and which is predi-

cated upon the mutually repellent propensity of like charges of electricity. In such a system the remaining electrons are external to the nucleus and surround it in satellite fashion. Such an arrangement gives the so-called "atomic structure." The second and more complex type of material system involves two or more nuclei with their associated electrons, and any arrangement of this sort results in the so-called "molecular structure." From these fragmentary descriptions it will already have been seen that the atom is in essence a minute solar system, quite comparable in arrangement to that solar system of which our earth forms a part, and to the infinitely vaster solar system of which our own solar system forms, perhaps, but one electron. Is not the universe, then, to be conceived of as made up of sets of solar systems ranging in size from infinitesimal to infinite?

The atom is ultra-microscopic in size—almost infinitesimally so. Certain popularly interesting facts regarding the characteristics of atoms have been culled from recent literature:

If 250 million atoms of copper or gold were put in a row, like marbles, touching each other, the row would be only one inch long. An electron is probably only one hundred thousandth of that of an atom in diameter."

If a hole could be punched in an electric light bulb small enough to let in a million atoms of air a minute, it would take a hundred million years to fill the bulb.

The atoms of matter are so small that it would take something like one hundred millions of them to bridge across a penny piece.

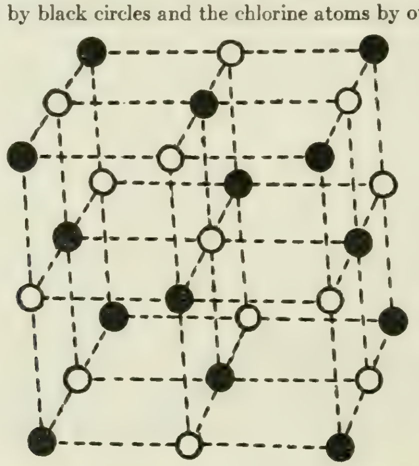
If an atom is magnified one trillion times, it would appear about an eighth of an inch in diameter.

Suppose we had means of segregating the individual molecules in a glass of water, and of labeling them so that we may recognize them again. Suppose then we emptied the glass into the ocean and let millions of years elapse, so that the water from our tumbler became thoroughly and uniformly mingled with that of the seven seas. Suppose after the lapse of this time we came back and took at random a fresh glass of water from the ocean—we would find in it no less than 1,000 of our labeled molecules. That is to say, the glass of water is to the individual molecule as the combined oceans of a thousand globes like the earth would be to the glass of water.

If we could magnify the point of a pin a billion-fold, we should find that a billion billion molecules can rest comfortably on this small area.

The mathematical disagreements indicate the nebulous state of the knowledge of atoms possessed by many who write about them.

By way of graphic representation, the following figure illustrates the arrangement of atoms within a cubic crystal. In this diagram (a crystal of common salt) the sodium atoms are represented by black circles and the chlorine atoms by outline circles.



What is the point of contact between this new conception of the structure of all matter and the production and transmission of energy as, for example, in the case of light and electricity? Briefly, it can be stated that the bombardment of atoms and molecules by radiant energy previously produced (and stored up) may succeed in bringing about a disruption of such atoms or molecules into simpler atomic and molecular systems or into electrons. The simpler structural arrangements thus derived from atoms and molecules, and which are electrically charged by virtue of a numerical inequality between their protons and electrons, are known as "ions," and the processes by which they (or even individual electrons) are derived from preëxisting atoms and molecules is known as "ionization." The form in which radiant energy capable of effecting ionization is most universally stored up is probably heat, though this statement has been challenged. But at any rate heat is one of the forms of such energy. Spectroscopy has proven that in the stars—not only in the hot stars, but in those of medium temperature and in the cold stars as well—ionization or atomic disruption into simpler atomic systems and electrons takes place, presumably as an effect of heat; and, as hereinbefore referred to, it was this fact which formed in part the basis of the discovery in the sun and other heavenly bodies of elements whose presence had been suspected but never proven. It is startling to think, however, that man has at his command sources of energy that are actually able to direct against atoms and molecules a force of bombardment far exceeding anything that can possibly exist in any of the stars. Electric currents of high potential (100,000 volts or more) passed through an X-ray tube and combined with pressure upon the gas under investigation have been made to produce ionization of a much higher degree than any that the spectroscope has shown to occur in the stars thus far studied.

This new particulate or corpuscular concept of matter and energy has relegated the "ether" to the scrapheap. Since all energy is now apperceived as the motion of actual material particles through space, the "hypothetical imponderable medium" which was so long ago invoked to explain the phenomena of light and electricity, and which had come to play so prominent a rôle in the world of physics that those two forms of energy were almost universally held to be merely properties of the ether itself, is no longer necessary, and has, therefore, been thrown into the "discard." Only minds engaged solely with the problems of physical chemistry (and perhaps not even they) can accurately gauge the overwhelming importance of the recently developed notion of matter and energy. Comprehension of all this is by no means easy for the layman, and humorous recognition of such fact on the part of our author is indicated in a short "polylogue," in which the characters are "Proton," "Electron," "Author," "Voice of energy," "General reader (by ether waves)," and "Scientific reader (through the same hypothetical medium)" in the order of their appearance. One very notable attempt to help the general reader over his difficulties is the glossary, wherein are to be found short, concise definitions of most of the scientific terms employed in the text. This little book will give to the general reader —who is neither a mathematician, a physicist, a chemist, a theoretical electrician, or an astronomer—the best available review (unencumbered by abstruse, mathematical formulae) of this epoch-making advance in science. It should be in the library of every household whose members desire a broad culture and the maintenance of contact with the progress of human thought.

A. N. Tasker.

A Manual of Clinical Diagnosis By Means of Laboratory Methods for Students, Hospital Physicians and Practitioners, by Charles E. Simon, B. A., M. D., Lecturer in Medical Zoölogy, School of Hygiene and Public Health of the Johns Hopkins University; Formerly Professor of Clinical Pathology and Physiological Chemistry in the University of Maryland

Medical School and the College of Physicians and Surgeons, Baltimore, Md. Tenth edition, enlarged and thoroughly revised, illustrated with 233 engravings and 23 plates. 8°, xxiv+1125 pp. Philadelphia and New York: Lea & Febiger, 1922.

The relationship between the clinician and the clinical pathologist in the medical circles of America is, to say the least, peculiar. True it is that a course of instruction in clinical laboratory diagnosis forms today a part of the curriculum of all medical schools in this country. In certain institutions this course is awarded a proper modicum of time and attention, and in such schools it is usually the case that throughout the whole of his clinical training the student is taught that a rational coördination between physical findings and the results of laboratory examination is an essential factor in all efforts to arrive at the most intelligent diagnosis. But this condition of affairs does not, unfortunately, prevail universally throughout the field of medical education in the United States. Every year the degree of Doctor of Medicine is conferred upon many graduates whose instruction in the methods of laboratory diagnosis has been superficial and inadequate. These young men go out to swell the rănks of that already large group of practising physicians who, because of ignorance of the value of laboratory procedures and a total lack of competence to interpret them properly when placed in their hands, sneer at the differential leucocyte count, the estimation of sugar in the blood, the renal function tests, the examination of intestinal contents to determine the presence or absence of the ova of the parasitic helminths, as well as all other analogous functions of the laboratorian, and entirely neglect, therefore, the opportunities which they ought to seize to take council with the clinical pathologist in consultation. It is not to be denied that there is another side to this picture. Occasionally we find one at present engaged in general practice who, having eked out his earlier income by filling the position of clinical pathologist in some hospital, has come to look upon laboratory diagnoses as the only ones worthy of consideration, and is, perhaps, as incapable of making a physical examination really worthy of the name as his confrère is of comprehending the meaning and intent of the results of laboratory investigation. Neither of these extreme points of view is more pernicious than the other. The only well-balanced internist is he who is possessed of such breadth of view and understanding as will enable him to compare intelligently those results which he has secured through bedside observation and examination of the patient and the reports supplied him by the clinical laboratory, and to assign due weight and importance to each. Except in rare instances no laboratory requests should ever be preferred before careful physical examination has been made, and then all such, but only such, laboratory tests as may seem to be indicated should be called for.

The author of the book whose title introduces this review may very justly claim to be a pioneer in the teaching of clinical pathology and in the introduction of clinical laboratory methods into many hospitals. With so long an experience behind him he is to be looked upon as one exceptionally well qualified to speak with authority, not only of the technical details of the subject with which he deals, but as well of the importance which that subject bears in relation to all other phases of diagnosis.

A comparison of the present edition with the preceding one shows careful

revision and very considerable expansion. Certain features deserve especial mention. Four new pages have been given up to the subject of the blood volume and its estimation. The section on blood sugar, including sugar tolerance and estimation of sugar, has been much amplified. Similarly the consideration of the nitrogenous constituents of the blood has been notably expanded. The same is to be said of the serological examination of the blood, especially with reference to the sero-diagnosis of syphilis, in which is included the procedure suggested by Sachs-Georgi and Meinicke. The parasitology of the blood has been rearranged in accordance with the accepted system of zoölogical classification. Especial consideration has been given to the functional study of gastric digestion according to the method of Rehfuss. The investigation of the biliary system following the method of Lyon has been gone into in detail inclusive both of the magnesium sulphate aspiration of bile and the characteristics of that substance (when obtained) in normal and various pathological conditions. The whole subject of animal parasitology has been dealt with *de novo* by a rearrangement which conforms to that classification of parasites now holding sway in the realm of zoological science. The various tests by which the functional capacity of the kidney is measured have been treated in detail.

It was in 1896 that Dr. Simon gave to the medical public the first edition of his work. In the quarter of a century which has intervened it has gone through ten editions. The reception accorded each succeeding edition by the clinical pathologists is evidence well worthy of credence of that characteristic excellence which has never been allowed to diminish or fail. It is today, perhaps, the best known and most widely used work on the general subject which American medicine has produced. There is every reason to believe that the tenth edition will enhance—if such be possible—the honorable reputation of the author among his professional colleagues, and that it will itself experience an expansion of its own usefulness and witness an ever increasing recognition of the value of those diagnostic measures of which it treats.

A. N. Tasker.

Artificial Limbs and Amputation Stumps, A Practical Handbook; by E. Muirhead Little, F. R. C. S. (Eng.); Consulting Surgeon to the Royal National Orthopaedic Hospital; Surgeon to the Royal Surgical Aid Society; Visiting Surgeon under the Ministry of Pensions to Queen Mary's Convalescent Auxiliary Hospital at Roehampton; Member of the Advisory Council and one of the Minister's Advisers on Artificial Limbs. With two hundred and sixty-seven illustrations; 8°, vii+319 pp. Philadelphia: P. Blakiston's Son & Co., 1922.

There is little doubt that amputation for diseases and injuries of the extremities was practised long before the beginning of the written history of medicine, and certain crude forms of prosthetic apparatus seem to have been used for nearly as long a period. Herodotus makes at least one mention of the amputation of a foot and its replacement by a wooden substitute. The Royal College of Surgeons of England possesses in its museum what is thought to be the oldest extant model of an artificial leg, which, having been found in an ancient tomb at Capua, would seem, from a study of other relics found with it, to have been made not later than 300 B. C. As far back as the

beginning of the sixteenth century artificial arms made of metal, and fitted with jointed fingers that could be flexed or extended with the other hand and locked into position by a ratchet, were in use, though probably not very extensively. Paré also gives descriptions of prosthetic arms and legs with quite minute and detailed drawings. All of these were supplied with mechanical devices by means of which they might be flexed and extended, though it was not until the nineteenth century that any attempt to bring the movements of artificial extremities under the control of the voluntary muscles (as, for example, those of the shoulder girdle) was made. Still later in the same century the details of mechanical appliances for voluntary movement of prosthetic arms and hands were much amplified, and several of the principles conceived and introduced by the Comte de Beaufort after the Crimean and Italian campaigns of the second French Empire have been revived and modified in the prosthesis of the present day.

It is a fair assumption that amputation for injury or disease of the extremities has diminished in relative frequency as the knowledge of aseptic and antiseptic surgery, and particularly of the "forlorn hope" viability of badly injured members, has progressed. Thus, Dr. Little states that for several years before the beginning of the World War amputation in Great Britain had become a rare operation, and that in a series of 5,483 major operations performed in the year 1913 at St. Thomas Hospital in London, there were only 34 amputations.

The purpose of amputation is twofold: (*a*) to save life, to interrupt the course of a wasting disease, or to secure for the body freedom from the incubus of a useless appendage; (*b*) to secure a stump which shall be best adapted to the application of some piece of prosthetic mechanism, and shall therefore be the most useful. Detailed measurement of stumps and the methods available for securing the most favorable stumps are discussed at length in the second chapter of the book here under review. The chapter immediately following deals with operative measures available for the improvement of stumps already formed but not well suited to prosthesis. The relations existing between natural joints and prosthetic joints, the comparative usefulness of arms and legs, provisional prostheses, arm prostheses in general, artificial hands, the British official arm prostheses. prostheses for the amputation of both hands, etc., and appliances for use with arm prostheses indicate the various subheadings of the whole discussion and description of the manufacture and application of artificial hands and arms. The prosthetic substitutes for amputated lower extremities are treated in an analogous manner and in equal detail. The value of the printed text is greatly enhanced by very numerous reproductions of photographs, of Roentgenograms, and of technical drawings which illustrate in detail the construction of the various pieces of apparatus under consideration, and the mechanical principles upon which their use and action depend.

Particular value attaches to the two appendices in which are given: (*a*) the specifications of artificial limbs based upon the recommendations of a committee appointed in July, 1919, to consider and advise upon the standardization of artificial limbs, and (*b*) the detailed directions for making certalmid sockets for artificial legs and for fitting the standardized light metal leg, together with a report of tests of the relative strength of wooden and of certalmid sockets.

This treatise will of necessity prove to be of great value because of the adequacy of its technical descriptions and illustrations to all orthopedic surgeons and makers of prosthetic appliances.

A. N. Tasker.

Clinical Symptomatology of Internal Diseases; Part II, Generalized Pain, by Prof. Dr. Norbert Ortner, Vienna. Only authorized translation into the English language of the 2nd German Edition. By Francis J. Rebman, with an introduction by Thomas Webster Edgar, M.D., New York, Medical Art Agency, 1922, xii+ 596 pp., 8°.

Among all the friends of living flesh, there is one more incessantly on guard against pathologic disturbance, especially if such be of the nature of acute inflammation or acute injury, than any other. This is Pain. Few friends wear perennially so forbidding an aspect and are so anxiously avoided by those upon whom their attentions are conferred; but our inherent dislike of Pain cannot obscure the truth that it is the most vigilant of all the sentinels that protect the members of the animal world against injury and disease. It is a general truth that the more portentous the danger that looms, the more insistent are the warnings with which Pain seeks to compel us to "stand from under." Only occasionally is the advance of the foe so rapid and insidious that the watchman is overwhelmed and silenced before sufficient time is allowed even to put the unsuspecting organism on its guard.

Pain has one frequent, though not constant, failing in the system of danger signals that it employs. It is often indefinite in location and diffused, and very frequently points its finger at a viscus or region that is not in actual fact the seat of the lesion to which it would call attention. It is because of these modalities—technically known as "referred pain"—that the semeiology of this one cardinal symptom of disease and injury has deserved and has received so much detailed study and description.

In the title of this book the term "Generalized pain" is used to include all painful sensations experienced by the human organism with the exception of pain in the abdominal region. This (abdominal) pain has been discussed in a separate volume. The subject is here treated under several different broad headings each of which indicates the site or general location of the pain whose diagnostic and semeiologic value is under discussion. These major subdivisions are as follows:

(*a*) Pain in the heart and cardiac region.
(*b*) Pain in the sacrum.
(*c*) Pain in the buttocks.
(*d*) Pain in the shoulder.
(*e*) Back ache.
(*f*) Pain in the neck.
(*g*) Pain in the nape of the neck.
(*h*) Pain in the chest.
(*i*) Pain in one side of the trunk.
(*j*) Pain in the extremities.
(*k*) Pain in the blood vessels.
(*l*) Pain in the nerves.
(*m*) Muscular pain.
(*n*) Pain in the bones.
(*o*) Pain in the joints.
(*q*) Headache.

Rhetorically the style in which the book is written is simple, easily comprehended, and definite in its indications. It is entirely free from those barbarous contraventions of good English usage that so often creep into translations, especially when the translator attempts to adhere too closely to the original text. Dr. Rebman is to be congratulated on the fact that his English version of this German work is entirely adequate, without

being too apishly literal. The combination is less frequent than it is desirable. While no fault can be found with the actual subject-matter nor with the simplicity and general comprehensibility of the language in which it is clothed, yet it might be suggested that, for American students who become so much accustomed to the use of tabulated statements, parallel columns, etc., during their undergraduate days, the value of the next edition could perhaps be enhanced by some condensation (at the expense of the smoothness and flowing quality of the style characteristic of the present volume) and by the insertion of a tabulated arrangement of the subjects dealt with in each major subdivision at the end thereof, in order that their interrelationships and relative importance might become more quickly evident to the student's "specking eye."

This volume adds something of very real value to the literature which deals with the whole general subject of symptomatology, and its careful use should result in not infrequent suggestions of a helpful nature to the practising physician who finds himself in a diagnostic quandary because of inability in given cases to evaluate properly the pain of which his patients complain.

A. N. Tasker.

Regional Anesthesia, Its Technique and Clinical Application, by Gaston Labat, M.D., Lecturer on Regional Anesthesia at the New York University; Laureate of the Faculty of Sciences, University of Montpellier; Laureate of the Faculty of Medicine, University of Paris; Formerly Special Lecturer on Regional Anesthesia, The Mayo Foundation, University of Minnesota. With a foreword by William J. Mayo, M.D. Octavo of 496 pages with 315 original illustrations. Philadelphia and London: W. B. Saunders Company, 1922.

Although the use of cocaine as a local anaesthetic was first brought to the attention of the medical profession during the latter half of the nineteenth century, and a compilation of the records of many operations performed under cocaine was made as early as 1887, nevertheless scientific "regional anaesthesia" has been of considerably later development. Indeed it has only within very recent years attained to its present state of definite exactitude. This fact depends in large measure upon the necessity for a very detailed knowledge of the anatomy of the whole nervous system (both central and peripheral), to which surgeons and anaesthetists did not, for a long time, give sufficient study. But of late years regional anaesthesia has tended more and more to replace generalized narcosis in surgery, and there can be no reasonable doubt that such anaesthesia will be employed with continually increasing frequency as time goes on. A detailed description of its "technique and clinical application" is therefore very timely, and Dr. Labat's book should do much for the instruction of anaesthetists in this branch of their art.

Two different types of regional anaesthesia may be defined:

1. Field block.
2. Nerve block.

The former "consists in creating walls of anaesthesia encircling the operative field. The solution is distributed fanwise in certain definite planes of the body, so as to soak al[the nerves crossing these planes on their way to the operative area. Sometimes one single wall blocks the desired area." Nerve block, on the other hand, "consists in making extraneural or paraneural injections in close proximity to the nerves whose conductivity it is desired to cut off. When the solution is injected close to the spinal column, at the emergence of the nerve trunks from the intervertebral foramina, it constitutes paravertebral block. Blocking the nerve trunks through the posterior sacral foramina is defined as 'transsacral block.' Injecting the sacral nerves on the anterior aspect of the sacrum is termed 'presacral block.' Blocking the nerve trunks within the spine, but outside the dura mater, is called 'epidural, extradural, or caudal block.' Blocking the roots of the

nerves within the spine, in the subarachnoid space, constitutes 'intraspinal block' by which spinal anesthesia is realized." The author gives the following rules which he looks upon as of prime importance, and to which close attention and strict adherence should be given in all regional anaesthesia:

1. Needles and other instruments should be tested before use, so as to make sure of their efficiency.
2. Solutions should be fresh and of accurate strength, the more so when they are intended for a poor surgical risk.
3. Adrenalin should be added to the anaesthetic solution just before use.
4. Colored solutions of adrenalin should be discarded.
5. Anaesthetic wheals should be raised wherever the skin is to be punctured except in the palm, sole, and scalp in certain cases.
6. The needle should be introduced through the wheal at right angles to the skin surface.
7. The needle should not be previously fitted on to the syringe when it has to be introduced in the vicinity of large blood-vessels.
8. Bones serving as deep landmarks should be approached lightly with the needle, since the periosteum is very sensitive.
9. No attempt should be made to hit the nerves; extraneural or paraneural injections are sufficient for surgical anaesthesia. But if the needle happens to hit the desired nerve, it should be stopped and the injection carried on at once.
10. Before injecting, it is advisable to wait a few seconds before adapting the syringe, and also to aspirate, so as to make sure that the point of the needle is not lying in the lumen of a blood-vessel, in which case the needle should be drawn back a few millimeters and its direction changed before proceeding any further. A small hematoma caused by the accidental wounding of a blood-vessel with the fine needle is, however, of no clinical significance, but intravenous injections of the anaesthetic drug may prove fatal.
11. Injections should be made slowly and the aspiration test renewed now and again, especially in paravertebral and sacral block.
12. Subcutaneous infiltration may be rapid, but steady and continuous, while the needle advances as well as when it is withdrawn.
13. No lateral pressure should be exerted on the needle for fear it may break.
14. The breaking of a needle within the tissues should call the immediate attention of the anaesthetist, who will himself extract the broken piece with greater facility, since he knows where it lies, unless it be situated too deeply to attempt extraction without the use of X-rays, in which case any other surgeon might interfere.
15. Care should be exercised not to break a needle in one of the sacral foramina, in the sacral canal, or close to the spine in the course of one of the paravertebral procedures, for these regions are not favorable for extraction, which is occasionally impossible.
16. The point of the needle should be drawn back in the subcutaneous tissue before any attempt is made to change its direction.
17. When the anesthetic procedure has been completed, the operative field should be tested with the point of a needle, or with a clamp if the patient's reaction to the pricks of the needle conveys any doubt as to the presence of anesthesia. If any part of the field is still sensitive to such painful stimuli, the responsible nerve or nerves should be located and supplementary injections made.
18. The patient should be sent in for operation completely anaesthetized unless otherwise desired, such as in cases of intended combined anesthesia.
19. Any fainting condition of the patient should call for immediate attention and be treated by the subcutaneous injection of caffein, 0.25 gm.; spartein sulphate, 0.05 gm.; sodium benzoate, 0.30 gm.; and strychnin sulphate, 0.001 gm., put up in a 2 c.c. ampule. These are exceptional cases, such as those occurring after intravenous injections, or injections of large quantities of strong solutions, or the use of impure solutions; but the anesthetist should know how to handle these patients.
20. The anaesthetist, whenever possible, should accompany his patient to the operating room and take care of him during the operation. A trained attendant may replace the anaesthetist at the head of the patient; but on no account should the patient be left alone. He needs intelligent watch and occasionally friendly encouragement.

For the rest, the first chapter of the book concerns itself largely with the instrumentarium, the various anaesthetics employed, and instructions to operating-room nurses.

The general principles of technique are very adequately discussed and graphically illustrated in Chapter 2, and the book then proceeds to a detailed description of regional anaesthesia in various localities under the following heads:

1. *Blocking of cranial nerves:*
   (*a*) Gasserian ganglion block.
   (*b*) Orbital block.
   (*c*) Maxillary block.
   (*d*) Superior posterior dental block.
   (*e*) Palatine block.
   (*f*) Infra-orbital block.
   (*g*) Mandibular block.
   (*h*) Inferior dental block.
   (*i*) Lingual block.
   (*j*) Mental block.
   (*k*) Superior laryngeal block.
   (*l*) Inferior or recurrent laryngeal block.
2. *Operations on the head:*
   (*a*) Scalp and cranium.
   (*b*) Operations on the face.
   (*c*) Operations on the nose.
   (*d*) Operations on the frontal sinuses.
   (*e*) Operations on the lips.
   (*f*) Operations on the eye.
   (*g*) Operations on the ear and mastoid region.
   (*h*) Operations on the upper jaw.
   (*i*) Operations on the lower jaw.
   (*j*) Operations on the parotid gland.
   (*k*) Operations on the tongue.
   (*l*) Tonsillectomy.
   (*m*) Dental operations.
3. *Blocking of spinal nerves:*
   (*a*) Paravertebral cervical block.
   (*b*) Brachial plexus block.
   (*c*) Median block.
   (*d*) Musculospiral block.
   (*e*) Ulnar block.
   (*f*) Paravertebral dorsal block.
   (*g*) Paravertebral lumbar block.
   (*h*) External cutaneous block.
   (*i*) Anterior crural block.
   (*j*) Obturator block.
   (*k*) Paravertebral sacral block.
   (*l*) Transsacral block.
   (*m*) Presacral block.
   (*n*) Caudal block.
   (*o*) Sacral block.
   (*p*) Sciatic block.
   (*q*) Great sciatic block.
   (*r*) Popliteal block.
   (*s*) External popliteal block.
   (*t*) Anterior tibial block.
   (*u*) Posterior tibial block.
4. *Operations on the neck:*
   (*a*) Operations on the thyroid vessels and gland.
   (*b*) Operations on the trachea and larynx.
   (*c*) Excision of the lymphatic glands of the neck.
   (*d*) Other operations on the neck.
5. *Operations on the upper extremities:*
   (*a*) Interscapulothoracic amputation.
   (*b*) Disarticulation of the shoulder joint.
   (*c*) Amputation of the arm.
   (*d*) Reduction of fractures of the humerus.

- (*e*) Operations on the axilla.
- (*f*) Resection of the elbow joint.
- (*g*) Reduction of dislocation of the elbow.
- (*h*) Reduction of fracture of the elbow.
- (*i*) Disarticulation of the elbow joint.
- (*j*) Amputation of the forearm.
- (*k*) Operations on the hand.

6. *Operations on the thorax:*
   - (*a*) Thoracotomy.
   - (*b*) Laminectomy.
   - (*c*) Simple amputation of the breast.
   - (*d*) Radical amputation of the breast.
7. *Operations on the abdomen:*
   - (*a*) Splanchnic analgesia.
   - (*b*) Laparotomy.
   - (*c*) Gastrostomy.
   - (*d*) Gastroenterostomy.
   - (*e*) Gastrectomy.
   - (*f*) Splenectomy.
   - (*g*) Operations on the gall bladder.
   - (*h*) Operations on the liver.
   - (*i*) Colostomy. Cecostomy.
   - (*j*) Appendectomy.
   - (*k*) Umbilical herniotomy.
   - (*l*) Epigastric herniotomy.
   - (*m*) Post-operative herniotomy.
   - (*n*) Inguinal herniotomy.
   - (*o*) Femoral herniotomy.
8. *Genito-urinary and rectal operations:*
   - (*a*) Operations on the kidney.
   - (*b*) Suprapubic cystostomy.
   - (*c*) Suprapubic prostatectomy.
   - (*d*) Perineal prostatectomy.
   - (*e*) Resection of the bladder.
   - (*f*) Operations for varicocele.
   - (*g*) Operations for hydrocele.
   - (*h*) Hemorrhoidectomy.
   - (*i*) Posterior resection of the rectum.
   - (*j*) Vaginal hysterectomy.
   - (*k*) Abdominal hysterectomy.
   - (*l*) Ovariotomy.
   - (*m*) Plastic operations on the vagina.
   - (*n*) Operations on the vulva.
   - (*o*) Cesarian section.
9. *Operations on the lower extremities:*
   - (*a*) Reduction of dislocation of hip joint.
   - (*b*) Excision of femoral lymph-nodes.
   - (*c*) Ligation of the femoral artery.
   - (*d*) Operations for varicose veins.
   - (*e*) Operations for genu valgum.
   - (*f*) Suture of the patella.
   - (*g*) Extirpation of the prepatellar bursa.
   - (*h*) Operations on the toes.
10. *Intraspinal block.*
11. *Discussion on spinal anaesthesia.*
12. *General discussion on the value of regional anaesthesia.*

The whole volume is wonderfully illustrated with anatomical diagrams and drawings in which the focal points are accurately mapped out. It is difficult to conceive that any book could surpass this one in its treatment of a very difficult and detailed technical subject.

A. N. Tasker.

The Practice of Surgery, by Russell Howard, C.B.E., M.S. (Lond.), F.R.C.S. (Eng.), Surgeon, London Hospital; Senior Surgeon, Poplar Hospital; Lecturer on Surgery and Teacher of Operative Surgery, London Hospital Medical College. Author of "Surgical Nursing," "The House Surgeon's Vade Mecum," etc. With 8 colored plates and 542 illustrations in the text. 3rd edition, 1,280 pp., 8°. Philadelphia: J. B. Lippincott Company; London: Edward Arnold & Co., 1922.

This textbook on surgery appeared in its first edition in January, 1914, but, as was true of so many other works of recognized value, the publication of later editions was deferred because of the World War. The third edition came from the press in April of last year.

The author states in the preface to the first edition that the book was written with a view to introducing the medical student to the subject of surgery and to preparing him for final examinations in that particular specialty. The careful arrangement and very clear and concise treatment of the individual subjects presented in the third edition make it evident that Dr. Howard's claim is as well founded now as it was in 1914. The book is essentially adapted to the use of the undergraduate; but, on the other hand, so much excellent diagnostic and therapeutic material has been included that it should also be of value as a work of reference for the practicing surgeon. In its outline it follows quite the usual course seen in textbooks on this subject. It begins with a chapter on infection immunity and serum therapy, which is followed by one on that most important of all surgical conditions, viz., inflammation. Wounds of various kinds and their complications are next treated, and this subject is followed by a discussion of the surgical aspects of tuberculosis and syphilis. Ulceration and gangrene, hemorrhage, tumors and cysts, and deformities are general concepts treated in individual chapters. Systemic surgery may be said to begin with "The blood vessels," and injuries and diseases of the lymphatics, tendons, muscles, bursae and nerves come next. Skin affections immediately precede a discussion of fractures, and certain diseases of the bones are then considered in a separate chapter. Dislocations and diseases of the joints conclude the surgery of the locomotor system. Abdominal surgery in general occupies one chapter, surgery of the stomach and duodenum another, and that of the intestines a third. Hernia is to be found in its logical place between the surgery of the intestines and that of the rectum. The diseases and injuries of the various abdominal viscera—pancreas, spleen, liver, gall bladder and bile ducts—are separated from those of the alimentary tract proper. The surgery of the head (and all of its component parts), of the spine, of the throat and of the thorax is dealt with very much *in extenso,* and the same may be said of the surgical affections of the female breast, especial reference being had to tumors. To the thyroid gland, to the kidneys and ureters, to the bladder, a chapter each is given, while the work is concluded with two chapters on the male genito-urinary system.

It is plainly to be seen that very careful and painstaking endeavors have been put forth to bring the whole book up to date. The influence of surgical experiences in the World War is particularly to be seen in the discussion of fractures and their treatment, and in that portion of the text which deals with the wounds and injuries of joints.

The author gives due credit by name to many of his fellow surgeons upon whose writings he has drawn for material incorporated in his own work. This very fact brings to mind one feature which many textbooks entirely disregard, but which might add very considerably to their value as works of reference. If bibliographical footnotes appeared at the bottom of appropriate pages (or, if preferred, the bibliography for each chapter might be appended at its end), such insertion would add very materially to the sources of information opened up to special investigators in special fields through the use of the particular work in question. Nor would such bibliographical additions add very greatly to the labors of the author. No excessive amount of time would be required to make

pencil notes of references consulted during the actual preparation of the text. The additional value and advantages would be well worth the effort.

One subject treated of deserves particular mention. Chapter XII on "Injuries and diseases of nerves" is shown, by a careful comparison of this with the preceding edition, to have been very largely rewritten.

In its physical get-up—binding, quality of paper, clarity of type, and well chosen illustrations—the book leaves nothing to be desired. It is, beyond possibility of contradiction, a very excellent textbook on the practice of surgery.

A. N. Tasker.

La Radiotherapie Profonde, par Iser Solomon, Radiologiste de l'hôpital Saint-Antoine. 8°, 152 pp. Masson et Cie., Editeurs, Paris, 1923.

Deep Roentgentherapy has become in recent years an element of exceeding importance in the general subject of the treatment of disease by radioactivity from various sources. More and more every day its technique is being standardized. Its clinical results have made themselves very notably manifest, particularly in the treatment of cancer and other tumors, and have served to awaken a widespread and entirely legitimate interest in this new therapeutic measure even among those who have not specialized in its field. Even the intelligent lay reader has acquired much general information concerning the influence of the Roentgen ray and various radioactive substances over cancer and other neoplasms.

This little brochure discusses and describes (*a*) The physical basis of deep X-ray therapy, (*b*) its technique, and (*c*) the clinical results obtained. The first chapter concerns itself with the fundamental physical principles upon which the general subject has been developed, the penetrating power of the Roentgen ray, its diffusibility, the determination and manipulation of dosage, and various other properties. In the next chapter are to be found detailed technical descriptions of the multitudinous pieces of apparatus concerned in the production and application of X-rays, while the third chapter deals with the actual procedures involved in making clinical use of this method of treatment. The fourth and last chapter is given up to a study of the clinical outcome of cases in which radiotherapeusis has been employed. The author classifies these cases in two large groups:

1. Benign conditions, including myomata, visceral and lymphatic tuberculosis, diseases of the glands of internal secretion, and diseases of the blood. He expresses the conviction that in these and similar morbid states the Roentgen ray with medium penetrating power gives the most satisfactory results.

2. Malignant neoplasms—sarcoma, cancer of the uterus, cancer of the breast, cancer of the larynx, and cancer otherwise located. These conditions imperiously demand deep Roentgen therapy. The statistics of this latter group of affections have been subjected to an analysis which warrants the conclusion that such treatment rationally applied by the hands of skilled operators, either alone or in conjunction with surgery, has proven itself to be of exceeding value and has very considerably augmented the percentage of cures.

A. N. Tasker.

Practical Physiological Chemistry, by Philip B. Hawk, M.S., Ph.D., Professor of Physiological Chemistry and Toxicology in the Jefferson Medical College of Philadelphia. Eighth edition, revised. With two full-page plates of absorption spectra in colors, four additional full-page color plates and 197 figures, of which twelve are in colors. Pp. 693. Cloth, $5.00. Philadelphia: P. Blakiston's Son & Co.

The eighth edition, revised, of this Physiological Chemistry offers an excellent reference book of high value to those teaching this subject in Class A medical schools. It presents its matter in such a way as to be readily available for use in the laboratory and

practically gives the sequence of chemical experiments suitable for demonstration to a class in medical chemistry. All directions are very clear and are accompanied by the inorganic chemical formulas where they are known. This makes an intelligent handling of this subject and links up its liaison with colloid and other inorganic chemistry in such a way as to place this medical subject on a strictly scientific basis. The book is a little too comprehensive for the medical student as a textbook though it is an excellent reference book for such purposes. Probably its highest value for this purpose is the large number of comparative charts and lists of classifications. Its chapters on vitamines and their relation to diets, on blood analysis and respiration and acidosis are exceedingly valuable. Its greatest claim for merit lies in the fact that it has in every way been brought up to date in so far as exact knowledge in each subject is obtainable. As a reference book in clinical laboratories its clarity makes it invaluable.

James F. Coupal,
Major, Medical Corps, U. S. A.

History of the Great War Based on Official Documents: Medical Services; Surgery of the War, Volume I. Edited by Major General Sir W. G. Macpherson, Major General Sir A. A. Bowlby, Major General Sir Cuthbert Wallace, and Colonel Crisp English. London: His Majesty's Stationery Office, 1922.

This is the third to appear of the twelve volumes which will constitute the Medical History of England's participation in the World War. The publication of three volumes of the history in such a short time after the termination of the war reflects great credit on the editor-in-chief and his collaborators. The present volume is the first of two to be devoted to the surgery of the war as it was observed by the authors and from a review of the official reports and literature pertaining to the treatment of battle wounds and their complications. The subjects considered in Volume I of the "Surgery of the War" is arranged by chapters are:

I. Projectiles.
II. Results of Projectile Action.
III. Wound Shock in Front-Line Areas.
IV. Wound Shock in Casualty Clearing Stations.
V. Blood Transfusion.
VI. Gas Gangrene.
VII. Tetanus.
VIII. Trench Foot.
IX. Anaesthesia.
X. Surgical Work in Field Ambulances.
XI. The Development of Casualty Clearing Stations and Front-Line Surgery in France.
XII. Wound Treatment in General Hospitals in France.
XIII. Surgical Work in Palestine, Mesopotamia and Macedonia.
XIV. Wound Treatment in Hospitals in the United States.
XV. Wounds of the Chest.
XVI. Injuries to the Pericardium and Heart.
XVII and XVIII. Wounds of the Abdominal Viscera.

The history is well written and brings out the salient features which were developed during the war regarding each particular subject. Each chapter is the contribution of one or more authors of well-recognized surgical ability and in every instance does full justice to his well-earned reputation. A slight rearrangement of the order in which the chapters appear would seem logical—that is, those chapters, (X, XI, XII and XIV) relating in general to the surgi-

cal work done in the various units both in France and in the homeland as well as to that in other seats of war—might well have been placed immediately after the chapters on projectiles and the results of their action, leaving the special subjects and wounds of certain regions to follow. This, however, is largely a matter of opinion. One other criticism which might be made is that for each chapter the figures, tables, charts and recorded cases are given a new sequence instead of running them consecutively through the volume. The colored plates are numbered in the latter manner. Reference to figures, charts and tables could be more easily made were they enumerated consecutively.

The varying conditions of warfare at different periods of the war have been considered and the important facts of each pointed out. Likewise, in many instances the location of the fighting, whether on the western front or in some of the eastern areas, made a profound distinction as to the character of the surgical lesions encountered. As this war was fought under tactical considerations which varied in a great degree from all previous wars and on a scale of greater magnitude than any other, many new problems relative to the transportation of the wounded and their surgical care in the various zones of activity had to be worked out. Experience proved the great teacher, and the lessons learned are well demonstrated in the greatly lessened incidence of certain surgical conditions such as gangrene, tetanus and trench foot, as well as a markedly reduced mortality from all wounds during the later years of the war.

In the chapter on "Surgery in Casualty Clearing Stations" are shown the difficulties which were encountered in the early months of the war in providing facilities for operative surgery near the front lines. Many wounded men were rushed hurriedly to the line of communications or to hospitals in England where they arrived with badly infected wounds or even with a general sepsis. When conditions permitted the casualty clearing stations to begin functioning this state of affairs was remedied.

That the failure to provide facilities for early operations was not alone responsible for the numerous infections is explained in the chapter on "Wound treatment in general hospitals in France." The general principles regarding the surgical treatment of wounds were regarded at the beginning of the war as well settled. This belief was based on the results attained in surgical practice in civil life as well as the experiences of the last few wars, especially the South African and Russo-Japanese. Few of the surgeons who served during the early days of the war had any conception of the course taken by grossly infected wounds or any experience in the treatment of such wounds. Their experience had been confined to the wounds of civil life, where, under a proper aseptic or antiseptic technique, infection seldom occurred in wounds. Furthermore, the confidence in the accepted general principles of wound treatment seemed justified by the observations made during recent wars concerning wounds by the ordinary rifle bullets of small caliber and the success which had attended their treatment. It had apparently been forgotten that "shell wounds, with the exception of clean leaden shrapnel bullet tracks, always suppurated." An additional factor to be considered in this connection was the highly infective nature of the fertilized soil of France on which the battles were fought.

It was soon discovered that the ordinary antiseptic methods of wound

treatment were insufficient for the care of the badly lacerated shell wounds which abounded in this war. The evolution of wound treatment is considered in detail until the perfected stages were reached where prompt "debridement" (although this term is not used throughout the volume) was practiced in every case, and the determination was reached that Carrel-Dakin solution, properly used, was the ideal wound disinfectant.

The reader will perhaps be surprised to learn that the number of officers and soldiers of the British forces wounded during the war reached the immense total of 1,997,199, of which 1,170,369 casualties occurred on the western front and 286,830 in the other theaters of war. With such a number of injured, the wealth of surgical material available for consideration is apparent.

The number of recorded cases of tetanus was 2,549, practically all of which occurred during the first year of the war. When compared with the 23 cases which occurred in our army, the value to our forces of the study of the experiences of those who had preceded us in the war is apparent.

The care of the wounded in the campaigns conducted in Palestine, Mesopotamia and Macedonia was carried out along the same general lines as on the western front, although the nature and extent of the territory over which the fighting extended made the evacuation of the wounded a much more difficult problem. Special mention is made of the remarkable absence of gas gangrene during the crossing of the Sinai Desert in Palestine. This was ascribed to the dry and unfertilized soil of this region.

The total mortality of chest wounds could not be directly ascertained but was undoubtedly high. Observations made of the dead on battlefields indicated that about one-third of the killed in action were wounded in the chest. Of a series of 3,521 patients with chest wounds the mortality was as follows:

	Per cent
At the field ambulance	7.0
At the C.S.C., 17.2 per cent of admissions=of survivors	15.9
At the base, 6 per cent of admissions=of survivors	4.6
Total	27.5

In a certain number of these cases the wounds were complicated by spinal or abdominal injuries which were responsible for death, but in so far as possible on hurried examinations, cases with serious complications were excluded in this series. The wounds caused by shell were more serious than those as a result of rifle or machine-gun bullets, which previous experiences had shown did well on simple, conservative lines of treatment. At the opening of the war the general expectation was that chest wounds, aside from those which proved fatal in a short time, would do well under simple treatment. Within a few months it became apparent that these wounds were not healing properly, and the deaths were ascribed to shock or hemorrhage. Investigation, however, determined that these deaths were mainly due to septic complications of the wounds. This discovery led to the careful watching of these wounds and immediate operation if signs of infection were discovered with a resultant lowering of the mortality rate. The results obtained after operation varied under different circumstances, naturally, being much better when surgeons especially skilled in this type of surgery were in charge. An interesting statement is that a fair proportion of empyema cases, which had been invalided to England, were back on full duty in France within a year of receipt of their wounds.

The chapter on "Injuries to the Pericardium and Heart" indicates a remarkable advance in the surgical technique of these exceptionally dangerous wounds. Operations were undertaken in many cases which hitherto would have been regarded as inoperable, and while the mortality was high the successful cases show that in properly selected cases operative intervention offers the patient a chance which before this time he had not often received. This chapter is replete with case histories and contains many excellent illustrations of specimens from the War Office Collection in the Museum of the Royal College of Surgeons.

With reference to abdominal wounds, the statement is made that at the beginning of the war the old axiom, that expectant treatment was preferable to operative intervention in wounds of the abdominal viscera incurred in battle, was concurred in by practically all surgeons. In the first battles of the war ample provision for operating near the front was an impossibility and the standard method of procedure was to permit the patient to remain in the nearest suitable medical unit, placing him in the Fowler position, withholding food and water and administering morphine. The results were what might have been expected, some few recovering, but the general case fatality was heavy. Post-mortem observations at this time indicated that in the great majority of cases the lesions were such that without prompt repair recovery could not be expected and that the prominent immediate cause of death was hemorrhage. To control the hemorrhage immediate operation was essential, and instructions were issued in a certain sector to rush the abdominal cases to the nearest casualty clearing station for operation. The results were so successful that instructions were issued for the rapid evacuation of all abdominal wounds to suitable units for operation. While definite figures are not available, it is estimated that in the preoperative period the mortality from wounds of the abdomen was 80 per cent. Compared with this the mortality in a large series of similar cases following operation was approximately 50 per cent, truly a wonderful advance to the credit of war surgery.

The volume as a whole is a remarkable contribution to military surgery and also must be regarded as of the utmost value to general surgical practice. It will unquestionably set a standard for the officers of the Royal Army Medical Corps for years to come.

History of the Great War, Based on Official Documents: Medical Services, General History, Vol. I. Medical Services in the United Kingdom; in British Garrisons Overseas; and during Operations against Tsingtau, in Togoland, the Cameroons and Southwest Africa, by Major General Sir W. G. Macpherson, K. C. M. G., C. B., LL.D. London: His Majesty's Stationery Officer, 1921.

In the preface of this, the first volume of a series designed to compile the part played by the Medical Department of the British Army in the World War, the author invites attention to the fact that hitherto the work of the Medical Department in war has never been published as a consecutive history but has been buried away in a mass of reports, general publications and articles in medical journals. In 1914, shortly after war was declared, steps were taken by the Director General of the Medical Services to perfect an organization for the purpose of collecting all records, statistics, case reports and specimens which might be of value in preparing a history of the activities

of the Medical Department. The committee then appointed was active until after the signing of the armistice, when a new committee was appointed to assume charge of the actual writing and preparation of the volumes. During the continuance of the war a large clerical force was engaged in studying, analyzing and compiling the reports and filing them in such a manner that all data would be available for the authors selected actually to write on various topics. With the appointment of the second committee, noted above, the selection of writers on the professional and scientific subjects to be included was completed. It is thus seen how a complete and comprehensive system for the production of the history was inaugurated and was then continued under the same general auspices. To these facts are probably due the appearance of the first volume in such a comparatively short time after the cessation of hostilities.

In the first chapter the changes in the organization of the Medical Department from the close of the South African War to the beginning of the World War are considered, and a description is given of the field medical organization of the army and of the hospital and sanitary units which were authorized. Then follows an account of the preparations for war, including a consideration of the regular medical personnel available and the plans for augmenting this number from civil life. The training of the regular medical officer, both in field work and professional subjects, is discussed, as is the organization of reserve units, the training of their personnel and the formation of a Nursing Service with a suitable reserve.

The mobilization of the medical services for the first expeditionary force is described. Each officer and enlisted man of the regular service as well as the reserve officers had already been provided with a document or card containing precise instructions as to which unit he would join under the provisions of the "Mobilization Instructions, Army Medical Service." Consequently, there was no delay in the organization of these units. However, the number of medical officers available was insufficient, and the proper cadre of officers was obtained by the temporary appointment of civilian physicians. In a very short time the Medical Service of the expeditionary force was ready and fully equipped for field service.

In succeeding chapters the following subjects are considered: The general administration of the Medical Services as exercised at the War Office; hospital accommodation in the United Kingdom, including the procurement of suitable buildings for this purpose and their adaptation to meet the needs; the disposal of sick and wounded, especially those returned from the various theaters of war; the examination of recruits; the recruiting of Medical Services; the training of the personnel brought into the Medical Services; the procurement and supply of medical and surgical equipment and stores; the sanitary organization in the United Kingdom; the organization of voluntary aid; and the demobilization of the Medical Services.

The latter half of the volume is devoted to a description of the Medical Services in the Mediterranean garrisons, Bermuda, Jamaica, Mauritius, Hong Kong, Straits Settlements, Ceylon and South Africa. Although there were no active field operations in any of these territories an uprising of the natives was responsible for a number of casualties in Ceylon.

A description is given of the work of the Medical Services during the operation against Tsingtau, in Togoland, the Cameroons and Southwest Africa.

In these chapters the author considers the character of existing medical garrisons at the beginning of the war with the steps necessary to supplement them; the character of operations contemplated; the nature and extent of terrain over which the army was engaged; the prevailing diseases; the sanitary program; the number of killed and wounded; and the methods of evacuating casualties. While some of these campaigns were on a fairly extensive scale and the medical problems encountered were most formidable, it is probable that due to the comparative insignificance of the operations as compared with those in the principal theaters of war, the average reader will give but little time to this section of the history, though it is most instructive.

The appendix of this volume covers almost 100 pages, mostly of tabulated matter, and contains among other topics a list of medical units mobilized in 1914; a list of hospital ships destroyed by submarines or mines; tables showing the number of sick and wounded arriving in the United Kingdom from expeditionary forces and overseas garrisons during the period of the war; tables of medical and surgical equipment and supplies; and casualty statistical tables of the campaigns in the Cameroons and Southwest Africa.

While a careful selection has been made of the important facts falling in the scope of the first twelve chapters and the author has concisely brought out the salient features, it is to be regretted that more detailed descriptions could not be given of such important subjects as the administration of the Office of the Director General, the hospitalization program in the United Kingdom, the training of medical personnel and the supply of medical and surgical equipment and stores. The magnitude of these functions of the Medical Department during the war would seem to warrant the presumption that an entire volume could readily have been devoted to each.

Some interesting figures are quoted throughout the volume showing the immense scale on which the war was conducted. During the period of the war a total of 154,374 men enlisted in the Medical Department in ranks other than commissioned officers while at the date of the armistice the personnel of the Medical Department numbered 144,514 officers and other ranks. The number of commissioned medical officers reached over 13,000, or more than half of the physicians of the United Kingdom. At the beginning of the war the army hospitals contained 7,000 beds, of which 2,000 were occupied, while during the war a total of 637,734 hospital beds were equipped, of which 364,133 were in the United Kingdom. Approximately 770 medical units were mobilized in the United Kingdom and dispatched to expeditionary forces. Seventy-five ships were equipped and 2,655,025 sick and wounded were brought to the homeland from the seats of war.

Grateful acknowledgment is made of the assistance rendered by this country in supplying medical officers for duty with the British Army when available physicians in the United Kingdom had been drained to the lowest ebb. The number of American medical officers attached to British units other than base hospitals was 1,253, while the personnel in American base hospitals serving with the British was 174 officers, 1,174 enlisted men and 734 nurses.

General Macpherson has written the entire volume in a most interesting and readable style, and after completing it the reader cannot fail to have a clear idea of the excellent work done by the Medical Department of the British Army in the United Kingdom and in certain of the theaters of war. A careful reading of this book will well repay physician or layman, whether connected with the military service or not.

Obituary

Those of our membership whose deaths have been noted since our last report are as follows:

Capt. Edwin T. Bruce, M. R. C., U. S. Army
Capt. Jesse S. De Muth, M. R. C., U. S. Army
Capt. Erasmus G. Hopkins, M. R. C., U. S. Army
Lieut. Col. Henry Ritchings, M. C., Ill. N. G.
Capt. M. H. Simons, M. C., U. S. Navy, Ret.

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THE MILITARY SURGEON

VOL. LII APRIL, 1923 NUMBER 4

SOME NOTES ON THE MANAGEMENT OF THE COMMON COMPLAINTS OF THE EAR, NOSE, AND THROAT IN THE TROOPS ON ACTIVE SERVICE; WITH A CONSIDERATION OF THE RELATIONSHIP WHICH SHOULD EXIST BETWEEN THE SPECIALIST AND THE MEDICAL OFFICER[1]

BY COLONEL PERRY G. GOLDSMITH, C.B.E., C.A.M.C.,

Consulting Oto-Laryngologist, Military District No. 2; Officer Commanding No. 16th Canadian Field Ambulance

I GREATLY appreciate the courtesy embodied in your invitation to the Canadian Army Medical Corps to send a representative to this meeting. I esteem very highly the distinction conferred upon me by being selected to represent Canada, a distinction carrying with it responsibilities I hesitate to assume, but rendered all the easier to bear as I know I am among friends and members of the same craft. As one who in his civil life thinks largely along the narrow lines of the oto-laryngological specialist and teacher, and almost has his being among ears and throats, it is natural that I select a medical topic dealing with diseases of these structures. So, too, have I had experience over two decades with military affairs, five years of which embodied duties overseas up through most all the medical military appointments that obtain to a great war waged a long way from one's home. Under such circumstances I might without egotism offer you some thoughts along the lines of the subject of my paper.

I have long since reached the conclusion that in the late war, so far as the ear, throat and eye are concerned, we suffered from *over-specialization*. This was due partly to the tendencies of the age, ill-informed public opinion at home, over anxiety of Parliament to leave nothing undone that conduces to the soldier's comfort and welfare, and lastly, the lack of sufficiently experienced regimental medical officers.

It is obviously difficult to make a civil practitioner, however well he may have mastered his art, to realize his new position. In peace the

[1]Read at the 30th Annual Meeting of the Association of Military Surgeons of the U. S., Washington, D. C., October 12-14, 1922.

citizen is free to choose any physician he cares to attend to his ailments or complaint and to change his adviser as his whim suggests. So, too, is it his privilege to have treatment for any of his discomforts, even though they are harmless, and not in any sense a disability, and the physician ministers to his patient, to whom alone he is responsible.

When a man is called to the colors, he becomes then the property of the state, and it is the duty of the state to provide for his medical needs. The medical officer detailed by the state to carry out this duty practices in an entirely different atmosphere than he does in civil life. It is not the right of the soldier to have his whim catered to, nor his discomforts rated as disabilities. An operation in civil life necessitating the laying up of a man for a week or two, even to relieve a minor discomfort rapidly, becomes an incident in the patient's life and in no way interferes very much with his affairs or that of others. In war this same proceeding may have a serious effect by:

1. Lessening the fitness of the man for duty, temporary or over a considerable period. Once in a hospital he seldom goes straight back to his unit as he has meanwhile been struck off the strength.
2. Encourages a man to go sick, since a hospital is much more comfortable than his lines.
3. Increases the potential pension list.
4. Reduces the morale of the remaining men on the strength.
5. Embarrasses his commanding officers, who may not be able to secure suitably trained and hardened men to supply such wastage.

The services of the soldier belong to the state, and the medical officer who initiates his being a casualty incurs a grave responsibility. The military situation must come first, the patient afterwards. Failure to realize this by medical officers is often responsible for the overcrowded hospitals, convalescent homes and command depots.

I have seen periods when England was calling up small shopkeepers with families to send them to some war quarter, for she fought in many in the last war, while militarily fit unmarried soldiers were kept in hospitals or at convalescent camps as interesting clinical studies, or undergoing treatment along the lines indicated by the prevailing fashionable pathology. To cope with this situation demands a medical officer trained as a soldier, not a brilliant surgeon or physician specialist. To illustrate my meaning let me cite an instance in the retreat from Mons in 1914. I was at Boulogne and opened the first special oto-laryngological clinic in the war. It was an afternoon clinic, while my mornings were occupied in dressing compound fractures of the femur under the direction of a general surgical specialist of the Imperial Forces. The retreat from Mons had almost finished, and walking

cases were coming down fast; all men were needed to hold the Germans back. I had many cases to deal with, and among the chronic suppurating ears were many with large aural polypi. These I simply pulled or snared off and sent the man back to the front without even having entered him as a hospital patient. Modern otology would look aghast at this, but the military situation came first, and the soldier was not nearly so liable to die from otitic meningitis as he was to be shot. This was in November, 1914, when the "Contemptible little British Army" saved the face of Europe. With the increase of men, the war being so long drawn out and not one of movement, better treatment of these cases was possible.

It would be obviously impossible for me to discuss the treatment of ear, nose, and throat affections according to a general plan, because in active operations in a war of movement almost no treatment can be expected by the medical officer of a regiment. The treatment of therapeutics is for those in charge of large station army hospitals or general hospitals at the base. Field ambulances or rest station may have facilities and qualified officers for a limited number of short time cases.

This brings up the question of the duties of the regimental medical officer. This duty, generally speaking, is not the treatment of the sick but the prevention of disease, and watchfulness against wastage, According to the regulations of the C. A. M. C., his duties are as follows:

> The Regimental Medical Officer; adviser of O. C., upon technical matters; attached for duty, discipline, pay, rations and quarters (in the field); receives his instructions and orders on technical matters from the S. M. O., district or division; examines recruits; advises on sanitation, quarters, billets, inspects food, takes sick parades; trains stretcher bearers, etc., etc.

There are times, however, when at large camps or training depots served by one large general hospital, with or without several small hut hospitals for cases lasting only a few days, that the regimental medical officer is called upon to actively take charge of patients for the day or two that determine the probable final distribution of the patient. If you will imagine such a military position as a large reserve camp, say in England as in the late war, I will endeavor to give you what I have been called upon to do on previous occasions—suitable advice to give to regimental medical officers on special case coming to the morning sick parade. The morning sick parade can be made a great feeder for an oto-laryngological service in the camp military hospital. In the hospital the specialist, if he is not a soldier, may by his enthusiastic operative zeal unfit many men for long periods in attempts to cure, by radical means, conditions that are not disabilities but are old abnormal-

ities that have existed for many years and do not incapacitate the soldiers for their ordinary duty.

Some of us are rather prone to compare the facilities for treating special cases of the ear, nose, throat and eye in the military organization of European armies with those obtaining on this continent. We in Canada are British, and our Army Medical Corps is trained after the pattern of the British Army, where the regulations are those based on many years of experience in wars all over the world. I have yet to see where these regulations were not best suited to the economic and military situation. True, local conditions and a siege war make minor alterations desirable, but the underlying principles were always sound. Why, then, the difference in the amount of attention devoted to ear, nose, throat and eye like our own. I think this is largely dependent upon the type of individual who becomes a potential patient. Could I better illustrate my meaning than to refer to the attitude we in civil life adopt to, say, a nasal discharge; when a man has a nasal discharge he at once thinks of the dread disease catarrh and rushes off to a specialist to take a course of treatment to be cured. The European, more prosaic in type, not over educated by sensational newspaper articles on medical subjects, is very little concerned, probably blows his nose a little oftener and pays no more attention to it. In England the atmospheric alterations conduce to an increased nasal discharge until the man becomes acclimatized, but in the meantime, unless he has facilities for attention immediately, he and his friends think a grave neglect is being incurred by the state. Environment and home criticism then may force the Army Medical Corps to create facilities for many specialties, and the more avenues you have along which the soldier can get sick, the greater will be your sick parade. A hospital devoted to disease of the thumbs would, I am sure, have a waiting list.

You will notice that I have used the word "complaint" rather than disease, for, if there is one thing a soldier is better to be without, it is the knowledge that he possesses some disease with a high-sounding name which in reality is some simple inconvenience. This makes all the difference in the world between his going sick almost every day and carrying on without any further bother. Furthermore, if those symptoms are not readily relieved, and it may not be possible to do so, he is liable to consider that he is being neglected and should be in the hospital. This goes on until some well-meaning person takes the matter up and a serious complaint follows when none really exists.

Nor must we forget that many of our cases have come from homes where parents sometimes are unduly sympathetic, and being now placed where this does not exist so largely and away from family doctors, they

are inclined to worry over slight variations of their usual state. This is increased by the monotony and severe hardships most of the men have to undergo. You will thus see that personality and environment have a real share in our sick lists, and again it is important—very important—to recollect that our climate and methods of heating our homes are so different from the humidity and open fireplaces in England, that we are prone to the many varieties of inflammation of the mucous membrane, which fact is borne out by the number of complaints, due to inflammatory condition of the upper respiratory tract.

I am further convinced that we on this continent have somewhat a habit of consulting a specialist for any complaint for which the profession furnishes a specialist, and this is in recent years a big item. In other words, instead of following the advice of their family doctor and seeking further consultations under his direction, patients run off to a specialist, assuming that he alone knows anything about any special organ. Sometimes I think this obtains in our own service, for patients who have only some simple complaint such as a slight ringing in the ear, which has existed for only a few days, are sent for special treatment, whereas it only seems reasonable that such cases should not be encouraged, at any rate to worry about trivial matters. Furthermore, I am not sure that the very fact that the medical officer sends such cases away he lessens in a measure the confidence the soldier has in him.

I am convinced that many a man will go away completely satisfied and pleased, too, by having his medical officer assure him that his complaint is not a disease, will lead to no further danger and will get all right by exercising a little patience. So often have I heard soldiers, when I have finished examining their ears or eyes, say, "I am glad to hear you say it is not serious, because it has been worrying me a great deal lately," and worry, gentlemen, leads to discontent and all kinds of imaginary ailments, just as in more mature life it rapidly increases the arteriosclerosis which has only just begun.

The danger of making our patients of the psychoneurotic type must not be forgotten. The regimental officer who has the power of developing by various means the soldier's cheerfulness, hopefulness, pluck and faith, has one of the most valuable methods of treatment to use in his morning sick parade.

SPECIALIST'S REPORT

The reports made on special senses, such as eye, ear and throat cases, for the information of the Medical Boards and Pension Board, must be very carefully differentiated from the report or examination made by the medical officer examining recruits. The former is made by a

specialist medical officer, i.e., one familiar with the various methods of examination of these senses, and one properly equipped with instruments for such an examination. The latter is made, I know full well, in a very careless manner, which in the great majority of cases simply consists in filling up the attestation paper with a very rough estimation of visual acuity.

So far as the hearing test is concerned, it is seldom, if ever, made; as far as the investigation of any middle ear disease is concerned, practically no effort is made to do this. But it would not be fair to assume from this that the Army Medical Service has not made any effort to afford facilities for this.

There are supplied a head mirror and aural specular for examination of the ears, and in ordinary daylight this should be sufficient to find gross defects in the ear drums and middle ear disease.

There are also instructions issued, which show very clearly how the test for sight should be carried out. Considerable difficulty, however, arises where the standard is frequently changed but where the alterations are not known by the medical officer examining recruits. Again, some difficulty is experienced by medical officers in the use of the metric system of measurement. In England, and in fact among all oculists (not opticians), the metric system is solely in use, while among opticians the inch system is used, as most all the test type cards in use in Canada are marked by the medical officer in recording the vision, but it is a very simple matter to use metric equivalents. There is, I will admit, a lack of completeness in the instructions in that many small points are left out which are presumed to be known by any medical man. It is surprising how little is known by the ordinary practitioner about the examination of eyes and ears. I know of many cases where a man with one blind eye has been passed as having normal vision in each; yes, and even a glass eye has passed more than once. Men very hard of hearing have been passed by the score, simply because they were able to read lips or, in the noise and bustle incident to their examination. the examiner has to use a loud tone of voice, which marks the defect in hearing. Many scores of men with chronic middle ear disease have been attested simply because no aural examination has been made, even cases when two radical mastoid operations have been carried out, necessitating the removal of the drumheads years before. I do not say that, because a man has a middle ear suppuration, he should not be enlisted, but such cases should be referred to an aurist of mature experience, preferably, too, with military experience, for an opinion, and if passed a note of the defect is made.

It has so oftened happened that medical officers have been overawed

by their commanding officers in the rejection of recruits. It should be noted that on the attestation paper there is a statement to be signed by the medical officer examining the recruit that "he does not present any of the causes of rejection specified in the Regulations for the Army Medical Service." These causes for rejections were practically ignored or unknown in many cases by those who examined recruits during the earlier period of the war. A certificate is given that he can see at the required distance, but no mention is made of hearing at all, other than in embodied in the general statement above. From this you can see it would be easy to enlist.

Now as to the reports of the specialists on cases appearing before a medical board, it should be noted that the D. M. S. has endeavored to protect the service as much as possible by giving a ruling that all eye, ear, nose and throat cases appearing before a medical board must have a specialist's report for the board's information. There has, however, in this department been some looseness in the reports, due to superficial examinations being made by the specialist officer, who in so many cases has had little or no experience as a specialist, and more often none as a soldier. This is very important because, before a specialist is able to determine what kind of service the man is fit for, he himself should have some knowledge of what constitutes the service. Furthermore, that something which a medical officer gains by constant and long association with soldiers and enables him to reach the essential points for pension purposes, is entirely lacking in officers who have no military experience. I have particularly, in reviewing the Specialists' Reports for Pension cases of deafness, been struck with the number of cases of deafness which the men stated did not exist before the war, but who readily admitted that they were dull of hearing. In the one case it was caused by active service which for pension purposes in aural cases may not make much difference, but it is cited as an evidence of the case in which a report may be misleading.

Now as to the specialist's report itself. I have long been of the opinion that the defect in the C. A. M. C. as regards specialists was that there had been too much specialism for our military purposes. The Imperial Forces, I think, so far as the eye, ear, nose and throat are concerned, have too little, especially in ear, nose and throat work. I know that the department is opposed to the use of special hospitals whenever it can be avoided, since it means a large increase of men who "go sick" on some special organs. I am furthermore convinced that the specialists reports usually given do not fulfill all the requirements the case demands. For example, the test of ordinary conversation alone is not sufficient because very seldom are stated the words used so that

in a future comparison the same words should be used, as some words, particularly those with "S," are heard badly only in certain types of deafness. This is a particular hobby of mine. I am firmly convinced that cases of ear complaint appearing for pensions should have recorded a full otological report which states the range of hearing for all tones, so that whoever examines this case in the future will have a complete record on which he can compare the condition of hearing as he then finds it with the condition as recorded on former examination. This is the reason that I have been in the habit of making such an apparently complicated and technical report of cases for the board. I wished to have a permanent record for *future reference*, and one that could be useful for comparison. Simply to say that a man heard ordinary conversation at 10 feet in each ear and his high tones are 2048 Dv. or less 256 Dv. is of little or no value to anyone who has to report on him in the future, since no record is made of the notes used in the test given, nor of the notes above 2048 which are so largely involved in various degrees of shell and neurasthenic deafness. This is why I try to record all the tones by monochord, words, whistle, and tuning fork, and carefully note the hearing by Politizer's acoumeter, which is a very simple, uniform test. This is of the greatest importance, but unfortunately it takes time and is very trying to the examiner's patience.

I am also convinced that the question of malingering does not receive the attention it should. I am satisfied that a considerable amount of this exists among our ear cases. In reviewing cases for boards, I was struck with the fact that this question must have been ignored, since I was able to detect several cases. It has been the experience of some of the best aural consultants in England that the percentage of aural cases who come up for pension awards, who have had previous aural trouble (anti-bellum) is as high as 90 per cent. In other words, 90 per cent of cases, if pensionable, should only receive a rate based on a condition made worse by active service. With all respect to the opinions the medical boards have at their disposal in estimating the percentage of disability for deafness, I am sure the Pension Board should have at its disposal an aurist of mature experience and one familiar with soldiers in war. Once a man is paid a pension and has it renewed, it is very difficult to cancel or reduce it.

I am, furthermore, convinced that in special cases there is a great lacking in accurate history taking, and I think that the history of all aural cases should be taken by the specialist who makes the report, and his history of the disability should accompany this report. Reports made by medical officers who have had only the experience gained by being house-surgeon to some special department are of very doubtful

value. Their estimation of the military value of the complaint or disability is made faulty by their training, which so often teaches them that all complaints or abnormalties require correction—the pensionable disability is therefore liable, likewise, to be very badly estimated. When reports are made in this manner and also by those unfamiliar with judging the good faith of the soldier, the result leads to injustice to the soldier and to the state.

Some of the most common complaints will now be considered and suitable measures for their relief discussed:

AURAL

Earache.—When one considers the intimate relationship existing between the nose, naso-pharynx, and the middle ear to mild inflammatory attacks of these regions in England, he is not surprised that attacks of mild otitis media with pain or discharge are so frequent. Pains in the ears alone, unless middle ear inflammation, are due reflexly to one of the following causes: (1) Acute faucial tonsil inflammation; (2) acute inflammation around the Eustachian tube; (3) carious teeth; (4) furuncle; (5) superior laryngeal nerve irritation.

Now you are all provided with a head mirror and ear speculum—at any rate one is easily obtained—and if the ear is examined by either light from a candle or lamp, or even a white cloud, and the membrane seen is not red and congested, it is fairly safe to look upon the case as one not due to acute middle ear infection. The same examination determines by local inspection of the canal, if there is an absence of furuncle. The examination you make with the tongue depressor shows whether it is probably due to any acute inflammatory disease in the throat. But, generally speaking, a man with a severe earache coming on with a head cold, the pain severe, deep and throbbing in character, has a severe middle ear infection, and one likely to be associated with the formation of an abscess in the middle ear, I think it wise, if assistance is available, to secure special advice or, at any rate, put the case in a detention hut, where he can be put to bed and further attention given. To leave him in the hut to moan and groan in pain does no good and unsettles the others in the hut. The procedure I suggest is as follows—and this applies to a severe earache, not a little twinge occasionally coming on in the ear: (1) Relieve the man's pain by a hypo of morphia gas ¼. Send him to the detention hut, where the following treatment will be of value. (2) Place the case in bed, a hot salt or sandbag next the ear. Frequent irrigation (gentle) with hot saline solution, the instillation of acid carbolic in XV, and glycerine ozi. Do not use this too strong or exfoliation of skin will follow. Pure anhydrous glycerine lessens the irritating effects of the carbolic. This

acts in a two-fold way: (*a*) It relieves pain and lessens congestion; (*b*) if the membrane gives way, it flows into a comparatively clean canal. The bowels should be freely evacuated with calomel. Remember the pain around the ear may be greatest over the mastoid. There is some mastoid tenderness in all middle ear inflammation, because the mucous membrane lining the mastoid air cells is inflamed together with that of the middle ear. But this does not mean the man has acute mastoiditis. There is little or no fear of mastoid suppuration, prior to the aural discharge, and then only after some weeks, but if the middle ear inflammation has been of an unusually severe type, as from streptococcus infection or pneumococcus, early involvement of the mastoid may occur.

The patient may rapidly respond to this treatment, together with use of a nasal douch, simple and non-irritating, which is for the purpose of washing out the naso-pharynx and lessening the swelling of the Eustachian tubes with improvement of tympanic inflammation.

If the pain persists, special advice may be sought and possibly a small opening made in the ear drum to permit the discharge to come away. In the event, however, of your efforts being unsuccessful, free discharge of serum and sero-pus from the ear will occur. This means that the ear drum has given way and the discharge has gained exit. The discharge may be slight in amount and last only for a few days. A considerable degree of deafness need cause no alarm, as this will rapidly subside, but if it does not inflation will hurry matters along. It is an open question just how much syringing is wise in acute middle ear suppuration. There are two schools—if I may use that term—one advocating dry treatment consisting in putting dry gauze wicks into the ear only and frequently changing them, the other of frequent syringing and the use of various disinfectants. I think, however, you will be well advised to have the ear cleansed with peroxide 30 per cent and then syringed several times daily until the acute process has subsided. When the discharge has undergone considerably lessening it is often of value to instill weak alcohol drops, say 25 per cent, in order to facilitate the middle ear to become dry. So you see that, simply because a man has an earache with some discharge which is definitely becoming better, there is no urgent necessity for his being sent to a hospital for constant specialist's attention. This does not mean that occasional visits to a specialist are not advocated, as, if such attention is near at hand, advantage should be taken of it. What I wish to point out is, that a great deal of the treatment of these cases can be carried out without the men appearing off the strength of their unit.

Chronic Middle Ear Suppuration.—Many men, unfortunately too many, give a history of a discharging ear, existing off and on for years,

and since coming to England it has reappeared in a somewhat aggravated form. There is no use saying these men should never have gone to war; the fact that they are here and on parade before you exists, and some measure must be taken to look after them. Simply because a man has a chronic suppurating ear should be no reason why he is unfit for service if man shortage exists. Statistics show that 75 per cent of people have at one time suffered from a suppurating ear.

Broadly speaking, I think one is safe in following this plan—if there is now an acute exacerbation of a former ear trouble, shown only by a reappearance or increase of the discharge and unaccompanied by any signs of general infection or invasion of neighboring structures such as chills, fever, pain, etc., one may treat the case by syringing—peroxide and weak alcohol drops—the aim being to overcome the acute process. This of course leaves the man with his middle ear still suppurating and his ear drum perforated. If he has good hearing in the other ear, and fairly good in the discharging ear, I see no reason why he is not able to carry on as he has been doing for many years without any complaint. He, of course, has always something to go sick on, and it depends largely on the Regimental M. O. just how many of these men are sent back either from France or for reboards. The amount of deafness then becomes, in my opinion, the deciding point; with both ears he may hear quite normally but one may be very deaf, and we must remember it is with both ears he works, not, as in shooting, with one eye only.

Reflex Earaches.—(1) Not infrequently we meet with cases of earache of varying degrees and not associated with any acute inflammation which is caused by a carious tooth. Obviously a dental surgeon should be consulted.

2. Acute pharyngeal infections are often associated with earache which subsides on improvement of the throat condition. One must remember that an acute pharyngeal inflammation not infrequently causes an acute middle ear inflammation by direct infection, and in this case it is not a reflex condition but a complication.

3. Furuncle, a very severe pain in the ear, agonizing in character, is present in these cases. The canal is narrow and excessively tender. There is no discharge, as it is outside the middle ear. Such cases should be sent to the hospital for incision under an anesthetic and proper illumination. In these cases, too, there is a very severe pain on pressure over the mastoid unless great care is taken, when pressing the mastoid, that no movement of the canal takes place. An enlarged mastoid gland in these patients, if tender, is often mistaken for an acute mastoid involvement. When a furuncle or furuncle exists, associated with an acute otitis media, greater difficulty in diagnosis will arise.

Deafness.—This is a very broad subject, and, for practical purposes,

concerns you more in its quantitative and practical element than in any other way. When men parade before you with a complaint of deafness, careful inquiry will often elicit the true cause of the deafness. For example, a man comes complaining of deafness, and you are able to get a history of the presence of aural discharge; the case is then one of chronic (acute) middle ear suppuration and the deafness is only a symptom of this disease. Another man complains of deafness of a few days' duration associated with a head cold which in peace times has often made him deaf for a few days. Here it seems safe to put the case down as one of Eustachian catarrh, which will probably rectify itself as soon as the rhinitis has subsided.

Again, a man may complain of sudden deafness, especially in wet weather or after swimming, but without any head cold. Your suspicion that he has an impacted cerumen is likely to be justified and the appropriate syringing can be carried out by yourself. Vertigo in the absence of aural discharge is more likely to be due to unilateral Eustachian obstruction, but in suppurative conditions may indicate serious mischief. Old cases of deafness which have had a very gradual onset and have resulted in the soldier becoming an excellent lip-reader, may be able to escape ordinary notice. You all know very deaf people who can understand spoken voices if they can see the lips. This man, who has been able through careless testing to get in the army, may be a grave menace if placed on a listening post, and it will be necessary for you to have the man appear before a medical board which will direct what disposal is to be made of him. As the board will require an ear report, it will save time if you attach this to your documents.

Generally speaking, if men are able to carry on their work, understand their platoon commander when not able to see him, and have not been pointed out as deaf, it will, I think, be best to carry on. Once, however, a man is sent to you as too deaf for his work, the responsibility for his future is with you. In the first instance you send him for special examination and report, making out whatever forms this report indicates. The question of the character of the deafness is of value only in that it determines what amount of the middle tones are lost, as this concerns the tones used in ordinary conversation. For example, you all have many men who have lost, say, all tones below 128 Dv. and some of those above 1,028, yet are not known to be deaf. Again, some are unable to hear the higher notes of the scale, say, above 7,000 or 8,000 and do not know it unless careful testing is carried out. These latter miss many fine tones in an orchestra. The human ear is able to hear tones from 16 Dv. to 30,000 and 45,000 Dv. This is normal or perfection. Do not expect perfect hearing. Satisfactory hearing

for military purposes is all you require—satisfactory for the duty this particular soldier is expected to perform.

But occasionally a very deaf man is placed on some base duty where deafness is so great that he becomes really a nuisance. I have had occasion to board out of the army men quite fit for labor of all kinds yet are only an annoyance to their officers when kept in the army.

It is very important, in making out your history of the disability in case of deafness, to get an accurate record of the deafness. Many will say that before coming to England they heard everything, but now are quite deaf. Careful inquiry will very often elicit the fact that there was some aural discharge some years ago, but it has now stopped, or that he found it necessary to sit near the front at the theaters and concerts, or even the man is now a lip reader, a positive proof that he has long been deaf. Such a record is valuable on his military history sheet and helps to make pension findings just.

A great majority of the men boarded for deafness have been deaf before enlistment. It is important for you to remember this and to realize the responsibility you assume in stating that the disability is the result of active service or made worse by it.

It is not a question of your helping some poor fellow to get a little money but rather a question of your assisting the state to deal with the case on its merits alone.

Tinnitis Aurium.—Tinnitis existing by itself is of little military consequence because it is not a disability. Occasionally, however, it is so loud that it is important, because in these instances it is associated with a deafness which is the real disability. Not infrequently the noise or ringing in the ears is of slight and short duration, usually associated with a catarrhal condition of the naso-pharynx and Eustachian tube. But one must not forget that a tinnitis, persistent or periodical in nature, often precedes by months or years a chronic progressive middle ear deafness and is little influenced by any form of treatment. Again, in men who are in the early stages of arteriosclerosis associated with an increased blood pressure and kidney condition, known sometimes as a small hard kidney with urine of specific gravity, say 8-15 and a few hyaline casts, we not infrequently find a tinnitis aurium with slight deafness perceptive in nature and due to vascular labyrinthine changes.

Nasal Obstruction.—In considering nasal obstruction in troops in England we must remember that periodical alterating nasal obstruction due to varying stages of congestion of the turbinal tissues is a very common condition among all of us, and, furthermore, you will be careful to differentiate between the nasal obstruction due to a slight stuffiness of the nose and no disability and that due to structural alterations

sufficient both to impair the proper preparation of the inspired air or even its sufficiency through the nasal channels. The former condition should concern you very little, for you will not encourage such patients to appear before you. You will give them some encouraging advice and have them use a menthol ointment (say, Menthol, grs. 111; camphor, grs. 111; and vaseline or petrolatum, one ounce) to sniff up the nose two or three times daily. Should, however, the soldier's general health or marching ability be sufficiently impaired, a special opinion will be advisable, and it is to be hoped that the operation measures to be undertaken will not be out of proportion to the extent of the disability.

There are many cases of recurring colds and bronchial inflammation due to, or rather kept up by, imperfect nasal breathing. These cases may very well have their nasal condition rectified, but remember that in all cases the military situation must come first. The mere presence of a deflected septum is not an indication for any operative treatment. Most people have a bent septum—a straight septum is abnormally normal—and all the soldiers you see have had it for years, but now it is giving some concern because the associated turbinal turgescence is more prolonged than usual and the resulting obstruction gives considerable alarm. It is a good general principle to follow to discourage intranasal operations during service.

Nasal and Post-Nasal Discharge.—Under this heading would come, I think, that common condition or complaint called catarrh. Strictly speaking, catarrh has no more to do with the nasal mucous membrane than any other mucous membrane, but common custom seems to permit anyone who has a nasal discharge to speak of his having catarrh.

For practical purposes we may divide these cases into two classes.

1. Those who have mucous discharge bilateral in character and generally associated with various degrees of nasal obstruction.

2. Those in which the discharge is mucopurulent in character, and often associated with facial or frontal pain. When a man, who has lived in a climate such as Canada, goes to England, it will take some time before he becomes acclimatized, and in the meantime he is liable to an increased nasal and post-nasal secretion, which increase depends largely on the amount of chronic rhinitis he had prior to his arrival. The more exercise and drill these men have the better for them. I do not see that they should become specialist's cases merely because they have an increased rhinitis. A nasal wash snuffed up from the palm of the hand consisting of saline solution 1 per cent or boric solution 5 per cent will do as well as anything. But it should be lukewarm, and here your difficulty comes in. Encouragement in these cases to blow the nose freely is advisable, not because it removes secretion but that

it tends to keep the necessary air space free. Most of these cases are cases of mild sinus inflammation and will rapidly subside. Warm weather is the great cure. These cases, however, will be benefited by using the menthol and camphor ointment above mentioned; besides it will be doing something and not let the soldier think that his case, in all its seriousness, is being neglected.

The symptom of post-nasal discharge or dropping in the throat is of course very annoying and distressing. It is usually due to a chronic nasopharyngitis, and in many cases this is caused by some adenoid tissue that has temporarily become inflamed. Its relationship to chronic rhinitis with or without sinus involvement and nasal obstruction is almost constant, and measures directed to the alleviation of this will assist in lessening the amount of discharge. In civil life one uses pigments, minor operation measures and carefully investigates the posterior accessory sinuses. This is difficult in war times, and one must really depend on simple expectant treatment. Bad ventilation and excessive smoking tend greatly to keep up this inflammatory state. There is another symptom often complained of which has to do with the naso-pharynx, viz., the formation of a large crust in the vault which the patient has great difficulty in being able to dislodge every morning or less often. If it is very persistent, usually there is a small sinus in the vault of the pharynx, the remains of its cleft in an adenoid mass, sometimes called Thornwalts Bursa, that is imperfectly drained that causes this trouble. Any measure tending to soften the crust applied through the nose, such as oil or ointment, may give some help, but if there is any difficulty to cure in civil life how much more difficult it is for you on active service.

Foul nasal discharges are of two kinds, one noticed by the soldier himself, and the other by his comrades. Atrophic rhinitis or ozena comes under the latter type. This is very troublesome and little can be done for it. I had occasion to invalid out of France a young man who was so offensive that his comrades could not sleep in the same tent. When the soldier himself notices the discharge, it is usually a suppurative antrum or a sequestrum, probably syphilitic in nature.

Sore Throat.—I am somewhat timid about approaching the subject, as it is one that involves such a variety of diseases that to take them all up would take too much of your time and would have, so far as the army is concerned, merely a scientific side rather than a practical aspect. I therefore propose confining my remarks to the ordinary run of cases you meet with in your morning sick parades, and help you as well as I can to take care of these yourselves rather than have them referred elsewhere. The great majority of the cases you see will be due to vary-

ing inflammatory state of the faucial tonsils. We may class the cases under two types, chronic tonsillar inflammation with frequent exacerbation, and acute tonsillitis.

Under the first type come those cases where we have an acute inflammatory condition of the pharynx, associated with and probably caused in the first instance by a tonsil infection. Cases again may be subdivided into those with enlarged or projecting tonsils with or without exudation and those which present small but not actively inflamed tonsils, but where the mucous membrane of the posterior wall of the pharynx is covered with a velvety layer and glandular enlargement.

If the case is one with marked tenacious exudation greyish in color, foul breath, and the exudation is found not alone on the tonsil but also on the pillars or of the soft palate, you must assure yourself that you have not to deal with a case of diphtheria. This you can do by immediately having the man sent to an isolation hospital and a culture made. An injection of antitoxine now will be advisable. In fact, all exudations are suspicious; if a culture is made it is the only way to prove your diagnosis. There are, however, many cases coming to you with moderate tonsillar inflammation, and spots corresponding to crypts of the tonsil. These are generally associated with symptoms of general infection called grippe, and not infrequently an attack of rheumatism.

You deal with these cases according to the severity of the symptoms. Many will need only a day or two of rest with the use of salicyl solution and free purgation; others again really need nothing, but you can give them some gargle which acts as a placebo. There are cases, however, where the tonsillar infection is more severe, constitutional, disturbances more marked with or without glandular swelling in the neck, which need treatment away from their lines. Particularly is this the case in those who have recurring attacks of quinsy. I have long felt that some throat tablets such as B & W Slippery Elm Bark and acid carbolic, with or without some menthol, say gr. 1/20 in each tablet, would be of real value if added to our Medical Companion. Gargles do very little good; they are also difficult to prescribe, because it necessitates a bottle when a better form of medication can be secured and one easy of application in the use of a tablet.

Ulcerative Conditions.—Vincent's angina is a form of mouth or throat infection due to a special organism and found so often in septic teeth. The inflammation produced is generally associated with a shallow ulceration covered with a grey exudate and whose contour presents no definite picture. The disease is not dangerous, is frequently found among several who are closely associated, and there appears to be an element of contagion present. A smear should be taken.

This can be carried out with no delay and a positive diagnosis made. I have found it very difficult in many of these cases to make a diagnosis between the affection and a simple ulceration on clinical grounds alone. Occasionally, however, and in spite of all efforts, the ulceration tends to spread very deeply. The treatment I have found best is to paint the ulcerated arches with a tincture of iodine and prescribe a peroxide spray. Some cases do better under strong silver pigments. Only the severe cases should go to the hospital. Serious cases respond well to copper sulphate, 10 per cent. A widespread outbreak may necessitate special measures to disinfect the canteen dishes so as to check the spread from that source.

Dysphagia.—This is a common complaint also and, when not associated with signs of active inflammation in the fauces, is generally of rheumatic origin. It responds well to massage of the neck and salicylates.

Tubercular and malignant ulceration of the fauces are very uncommon, and your suspicion will be excited as much by the general condition and history as by any peculiarity of the ulceration.

Syphilitic Ulceration.—These will be found rather often. Those in which there are mucous patches you will probably see oftener than those of true ulceration, which will be associated with other constitutional conditions. Once you have such a case the army says you will send them to the hospital, where special facilities are provided for their treatment and definite regulations as to their subsequent supervision.

Hoarseness.—This symptom, common as it is, may be one of the most difficult for which to find the cause. The great majority of cases, are, of course, due to colds, influenza or la grippe, which has spread down from the nose, naso-pharynx and pharynx. All degrees exist, from a slight roughness of voice to almost complete aphonia, in which instance there is nearly always a small functional element. Simple acute laryngitis, I think, is best treated in a hospital where the patient can be placed in bed and have regular inhalations administered. It will, I am sure, save a lot of time. In this way you will be able to lessen the number of severe attacks of bronchitis. But simply because a man has a slight cold and roughness of voice, it is no reason to send him to the hospital if active and important operations are about to begin.

We see many cases of hoarseness of slight amount frequently recurring in the spring and in units at home, and associated with little or no constitutional manifestation. The dampness in England and excessive smoking are the main causes. Such cases can very well carry on the symptoms, are not a disability, and do not lead to any further trouble. But cases of persistent hoarseness in older men must entail a very

thorough examination, since the hoarseness is due either to a mechanical interference with the production of sound due to a chronic inflammation of the laryngeal mucous membrane over the cords or to an interference with the enervation of the larynx. The former is of slight significance while the latter points to one of two things: (1) Recurrent paralysis due to aneurism of the arch of the aorta; (2) malignant disease of the oesophagus, enlarged mediastinal glands or early bulbar paralysis. Of course you must remember that the movement of the vocal cord may be impaired by new growth, which in older people leads you to suspect a malignant or a syphilitic infiltration. I think it well to seek, in your cases of hoarseness of any duration, the opinion of a laryngologist.

Coughs.—Regarding this, it is sufficient to say that one must remember that wax in the ear often causes a persistent cough. Cough is often the final stage of a descending cold or pharyngitis and the sound of the cough causes fear among the others. Excessive coughing causes hoarseness. Excessive smoking is another frequent cause. A cough, however, which persists must be thoroughly gone into. A thorough examination of the chest is essential, sputum examination must not be neglected, and in order that your pulmonary examination be thorough you must have time and the proper place for this examination. Do not hesitate to call another medical officer—I am sure the officer in charge of medicine in any hospital will be glad to go over the case with you. Remember an early case of tuberculosis may be cured now, but if missed and allowed to go on active service and its hardships, the case may become hopeless. This does not take into account the danger of dissemination which has all along been present.

FUNCTIONAL AND NERVOUS HEART DISORDERS[1]

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THE field of heart neuroses, like that of so-called neuroses in general, has grown constantly narrower, but a sharp and positive definition of just what we understand by heart neuroses cannot even now be formulated. As a rule we start from the negative and assume that all those disorders in which organic changes of the heart or vessels cannot be demonstrated, and which do not lead to the syndrome of circulatory insufficiency, should be regarded as functional or nervous. However, this is too narrow on one hand and too broad on the other, since it has been shown that disturbances of heart capacity or capability in which, by existing methods of investigation, an organic disorder can be ruled out may lead eventually to circulatory failure (Basedow heart). Moreover, we often see that organic disorders become overlain with functional ones and that a part of the heart complaints with an organic basis are to be traced back to this functional overlying. In such cases we must therefore regard as functionally produced all those disturbances which cannot be explained on an organic clinical basis. Most difficult, however, is the differentiation of certain forms of irregularity of the heart beat, since we find these in organic patients as well as in patients otherwise sound and up to the present time no fully definite origin of their pathogenesis has been recognized.

Our war experience has led to great advances in the field of functional and nervous cardiac disorders, above all because of the great number of observations, the light thrown on etiology and symptomatology, and the very fact that such numerous disturbances of heart function were found brought it about that the behavior of the soldier's heart was observed from many sides, the facts being generally in agreement, although explanations were various.

The greatest difficulty of all was in the precise differentiation between functional and cardiac disorders. Since newer methods of heart diagnosis have shown that even a heart with perfectly normal sounds, with no signs of muscle trouble and no history of illness leading to muscle damage, can, under certain circumstances, notably following overexertion, show evidence of disease leading to circulatory insufficiency, the difficulty in differentiating has been enormously increased. Subtle methods of investigation such as Röntgen procedure, graphic

[1]Translated from Handbuche der Arztlichen Erfahrungen im Weltkriege, Vol. III; Innere Medizin, by Capt. L. B. Pilsbury, M. C. U. S. Army.

methods, the electro-cardiograph, blood-pressure measurement, the plethysmograph and the various combined methods of examination of heart function are often called upon to make the distinction, but they fail in many cases and are not applicable in others, so that it often falls to clinical observation to say the last word. Just as during maneuvers in time of peace it was hard to decide to what extent the individual heart grew under increased exertions and to what extent the more emphatic claims concerning the circulation were justified, so during the war this question was difficult and important on account of the numbers of men who were eliminated as unfit then, as well as in peace times. It followed that among those eliminated during the war there were a great many with cardiac disturbances who, in proportion to the total number, were perhaps not so numerous relatively, but who required hospital treatment for months at a time and therefore accumulated in such numbers that the relative number gave the impression of being larger than it really was. Thus it is easily explained that most of the studies on this subject emanated from hospitals in the domestic zones well back of the lines. Doctors at the front had few opportunities in this direction and especially during the early years of the war such observations in hospitals near the front lines were less frequent than later when fighting men must be selected with less care. It is possible to make a classification of these cases, which, leaving the demonstrably organic out of account, presents the following functional disturbances:

1. From toxic causes, and here we must distinguish between autotoxic disorders brought on by abnormal repression of internal secretions and heterotoxic disorders caused by food poisoning, drug poisoning, inhalation of poisonous gas, etc.

2. From constitutional causes, including cases with poor cardiac and general physical endowment and lack of nervous and mental instability, this congenital defect making up for lack of other causes.

3. There are also circulatory disturbances resting on a psychic basis and occurring as symptoms of general neurosis, of hysteria and neurasthenia.

4. Further, we have disorders of the circulation caused by injury to the cardiac nerves themselves.

5. Disturbances which are considered as reflex from other organs.

This classification is not altogether sharp and definite, because we cannot with certainty exclude other noxious causes in those cases which seem to rest, for example, on a psychic basis. This is especially true considering that organic disorders can be overlaid by functional ones.

The causes of the increased incidence of such functional or nervous circulatory disturbances are to be found without a doubt in the special

and unusual circumstances of war time. Many constitutionally weak persons, who in peace times perhaps never knew they had a heart, fell ill under the physical and mental strain of war since they had not been fully prepared for it. It was true, of course, that the troops drawn in later could not be trained so long or so carefully as in peace times.

Furthermore, the vicissitudes of war were such as are found in times of peace only in severe catastrophes such as earthquakes, great conflagrations, railway accidents, etc. It must also be remembered that the compensatory rest which alone can make up for the exhausting effect of tremendous mental and physical excitement was often lacking because of the necessities of war. Other adverse psychic factors arose from the fact that especially among the older soldiers there were many who had left their families at home under such circumstances that they carried a perpetual burden of care with them wherever they went. It also came about that the necessity of making an intense and sustained effort which subordinated the will of the individual for months or even years at a time produced under the influence of ever repressed emotions a degree of tension which manifested itself finally in the form of disturbances of the circulatory organs. Such impressions were increased by the occasional furloughs home which were made possible to all by the long duration of the war and the long pauses in operations. At such times, the contrast between the circumscribed but peaceful life and the often lucrative industrial employment at home and the life in the field of operations produced a painful influence on the mind. The same thing was noticeable when wounds and sickness made necessary a long stay in the garrison and home hospitals. Then came the psychic infection with which nervous patients inoculated others, so that in suitable places an entire endemic could be started by a few neurotics. Although in the beginning of the war the feeling of duty and the wish to defend the home kept under egocentric feelings in nearly everyone, the longer the war lasted the more these feelings asserted themselves, and also the example of sound and dutiful comrades who were fully fit in the beginning being swept away and fewer effectives coming to take their places made the repression of unhappy feelings ever more difficult and more rare. The long cessation of military operations increased the unfavorable influences and gave them the opportunity to spread among the closely packed troops. There was, in addition, the unfavorable effect of an alternating liberal and scanty diet as happens in war time to everybody. The great need of stimulants, the first place being taken by tobacco, led to the consumption of incredible quantities, which had a bad effect on the nerves and on the circulatory organs. Therefore it is easily understood that the functional cardiac disturbances increased

manyfold and attracted attention especially on account of the long duration and failure to yield to treatment. Also in many cases false diagnoses contributed unfavorable influences to those afflicted with functional heart disorders, inasmuch as they became convinced that they had actual heart trouble. Heart failure, dilatation of the heart—these words occurred all too often and established themselves in the consciousness of the patients who found therein confirmation of their own conviction that they had bad heart trouble and could never be convinced to the contrary.

All the way through until the end there occurred, in all scientific papers dealing with heart disorders of soldiers, the question whether these were to be looked upon as organic or as psychogenic disturbances. In particular, opinions are at variance as to how the heart muscle comes through in such cases. The effort to find something objective in the heart so as to reach a definite decision concerning the exact pathological origin of these cases has been unremitting.

Any enlargement of the heart is often seized upon as a sign of organic trouble, but this will be discussed later. The behavior of the heart shadow with movement of the diaphragm as described by Zehbe should be tested further. In many patients who complained of subjective heart symptoms it was found that the surface of the heart lying next to the diaphragm broadened when the diaphragm rose. This was also observed by Plaut.

I have tested this behavior many times, but in purely functional disturbances, in which myocardial disorder could not be demonstrated by the history or the findings, I have never been able to convince myself that it appeared often or regularly as a symptom of tired or nervous heart. It is to be found also in people who have never complained at all of their hearts. F. A. Hoffmann sees a symptom of flabby heart in an increase of the angle between the left heart-border shadow and the diaphragm and has also found this often in cardiac neurasthenia. It is supposed to be an objective sign of existing heart disorder if this angle measures 90 degrees or more. The behavior of the blood pressure is regarded as especially important by Vollmer. It has seemed to me as to many other observers after numerous measurements that no differential diagnosis between functional and organic disorders can be based on blood pressure findings. The pressure varies so often in its height, both maximum and minimum, in all these patients that at the most the inference of nervous influences is to be drawn from this variable behavior, while from a transient increase in pressure the advent of an organic disease of the heart or vessels can never be inferred.

As far as pulse rate is concerned it is also unjustifiable to conclude

that an organic disorder is present because of abnormal rapidity at rest, standing, lying, sitting or after brief exercise, usually ten genuflexions.

E. Weber's method of testing function by means of the plethysmograph is not suitable for general use as it is so extraordinarily difficult to set up and exhibits so many errors which are especially hard to exclude in nervous patients, that it is out of the question for every-day use, even overlooking the fact that its theoretical basis is perhaps not beyond question.

Irregularity of the heart is only associated with organic conditions in certain well-defined cases. Long-continued conduction disturbance and ventricular fibrillation with absolute irregularity of the heart beat are nearly always indicative of organic conditions, but not transitory manifestations of this sort.

The otherwise applicable methods of pressure estimation combined with pulse rate and of ausculatory investigation for determination of function as employed by Schrumpf, Strassburger, Graupner, Rehfisch and others are also not useful for this purpose. In the judging of doubtful cases the last word cannot always be spoken through clinical investigation and observation, and in general it may be said that in this connection the experience and qualifications of the individual physician are of the greatest significance.

So long as uncertainty and misunderstanding reign in this field, so long as there is no unity or clearness of comprehension, just so long the opinions of the various investigators will disagree. Lack of critique and of scant insight into the pathologic physiology of the circulatory organs always bring the danger of false judgment to the individual physician, and even the most experienced often find it difficult to discriminate.

In this connection the need of care in taking the history and the psychic status can hardly be overemphasized. The more searchingly we investigate the history and the deeper we penetrate into the psychology of every patient the easier it will be to come to a decision. However, this requires time-consuming and often difficult analysis of each individual case, and this could scarcely be carried out in hospital at or near the front, as there the chief attention of physicians was turned to the wounded and seriously ill.

This analysis was possible, however, in the hospitals lying farther back where these patients, if not obvious cases, were held long enough so that intensive examination was possible. Under this sort of scrutiny it could nearly always be decided with certainty whether the disorder was organic or a functional one.

Since the diagnostic point of view was often clarified by the success

or lack of success attending well established methods of treatment, these were never to be neglected. Experience showed that methods effectual in organic cases nearly always failed in functional ones. In just this direction experiences of the World War teach much that is new. The application of such sovereign remedies as digitalis failed throughout in functional disorders, so that this very failure was of diagnostic importance in any given case. In just the same way the customary treatment with carbon dioxide and electric baths was of no avail. On the contrary, the patients often said that the baths made them worse. Isolated favorable results were occasionally obtained, it is true, since a certain suggestive effect goes along with the baths. The handling of the functional cases had to be different all the way through from that of the organic ones; it had to be directed according to the variety of disturbances, the constitution and the condition of the patient, the etiology and the duration of the trouble if any result was to be expected. Certainly psychic treatment was most efficacious in those instances where the patient had first to be deprived of the idea that he had actual heart trouble, which was more especially difficult if he had been told before that he was suffering from an organic heart disease. The most effectual therapeutic influence was, of course, withdrawing from the patient the physical, and especially the mental adverse factors; and as soon as the war ended we saw, as we did in prison camps during the war, that there were very few functional heart disturbances, although uncertainty of existence and of future were always present in the lives of many of them. And exactly those who labored under such difficulties, if they had acquired their symptoms at the front, were so affected by the fact that the war's ending removed their heaviest burden that they lost their symptoms and returned to full efficiency.

After this general discussion we arrive at the point of considering separately the various observed forms of nervous or, more broadly speaking, functional circulatory disturbances.

A. Toxic Factors.—Observation of all cases of functional heart disturbances put in this class by reason of etiology shows that the autotoxic forms are of much less significance than those arising from other toxic causes. Goiter and Basedow heart will be discussed elsewhere. Many authors, like Ehret, look upon the generally observed functional circulatory disorders as "formes frustes" of Basedow disease, basing the diagnosis on the tachycardia, fine digital tremor, perhaps also slight thyroid enlargement and prominence of the eyes found in many cases. True Basedow disease, although its nervous origin is strongly emphasized nowadays, was very seldom seen in soldiers. In my experience among

more than 3,000 cases on whom I have notes, there were only five who showed a fully developed Basedow disease. Judging from this very small proportion of true Basedow syndrome, it would not be justifiable to say that a "forme fruste" was so frequent. Moreover, H. Curschmann has shown that the cases of nervous tachycardia examined by him by means of adrenalin eye tests and estimation of lymphocytes failed to give any results characteristic of Basedow's disease. Therefore we cannot hold to the opinion that thyrotoxic disorders were especially frequent during the war or that they account for many cases of functional heart trouble.

It is quite otherwise, though, with heterotoxic manifestations. With these it should be emphasized again that their action may be enhanced by a mental and nervous component. The principal poisons to be considered are tobacco and alcohol.

The use of tobacco was extraordinarily widespread in the army. Especially did the use of cigarettes increase as the time passed. At first a daily quantum of tobacco was issued as belonging to the ration, and especially during the first years of the war cigars and cigarettes were the most frequent gifts so that there was seldom any lack of them. The cheapness and plentifulness of tobacco led to its increased use by once moderate smokers. On the other hand, some who never used tobacco before smoked now in default of any other form of amusement. Many alleged that they experienced the sedative effect on psychically stimulated nervous systems which is attributed to tobacco but which has no experimental foundation in fact. The almost constant open-air life, the hard muscular work, the lack of diversion, the frequent huddling together for hours or days at a time in underground or very narrow quarters in constant peril created such nervous tension and craving for diverting occupation that nearly every one wished to try the effect of smoking. The example of their comrades, the lingering in smoke-filled rooms, induced those who under other circumstances never smoked to succumb to the universal habit when they would not otherwise have done so.

It is a well-established clinical and experimental fact that the use of tobacco can influence the circulatory organs unfavorably. According to Langley, nicotine is a poison to the sympathetic ganglia; it paralyzes the peripheral ganglia and hinders the conduction of impulses. The influence of the nerves upon the heart is thereby diminished and control influence cannot get through. Moreover, nicotine is not the only injurious element in tobacco, its bad effect being shared by the pyridin bases, pyrodin and kolidin. There is also evolved, when tobacco is burned, a very small amount of carbon monoxide, hydrocyanic acid,

carbonic oxydual, ammonia and carbon dioxide which can accumulate in a small smoke-filled room and be inspired.

Often, and especially in the later part of the war, other plants were used to adulterate the tobacco in cigars and cigarettes, such as hops, beech leaves, *Asperula odorata*, *Melilotus officinalis*, *Callendula odorata* and others which contained narcotic and otherwise deleterious substances, not to mention the fact that the maceration of tobacco itself will often yield nitrite and narcotic components. All these work together with the nicotine upon the circulatory and nervous systems and lower the efficiency of the heart and blood vessels.

Concerning the bad effect of tobacco smoking on the vessels it is well known that chronic arteriosclerosis of peripheral as well as coronary arteries can be traced back in many cases to the immoderate use of tobacco. (Erb.) However, this need not be considered here. There occur under the use of tobacco spasmodic contractions in both peripheral and central arteries, vessel crises according to Pal, where and when the coronary arteries are affected, as they often are, in the form of angina pectoris. Various spasmodic pains in the region of the heart are also caused in the same way.

There is also often observed, with excessive smoking, prolonged tachycardia and irregularity of heart action. By way of differential diagnosis it has been observed that when smoking stops the disturbances vanish.

The form of heart irregularity most often seen in these cases is extra systole, the premature occurrence in an abnormal way of beats occurring in the regular rhythm of the heart. Corresponding to extra systoles there occurred attacks of extreme tachycardia in smokers. I myself observed, in three patients who had previously had such attacks, that when they took up smoking again under the influence of army life after long abstinence, severe attacks recurred after long absence. It seemed reasonable to attribute the attacks to the effect of nicotine upon the sympathetic ganglia. The attacks always diminished when tobacco was given up.

Injuries from tobacco were nevertheless not so frequent as the widespread abuse of it would lead one to expect. The possibilities of injury were much reduced in the case of those who were exercising in the open air a great deal where tobacco smoke was breathed only well diluted. Here, also, the manner of smoking made a difference. Inhaling of the smoke into the bronchi, which many practiced as a routine and others to increase their enjoyment, is likely to increase the resorption of injurious gases and to bring on symptoms of intoxication which are absent when the smoke is simply drawn into the mouth.

Injurious effects of alcohol on the circulatory system were relatively less frequent and were observed more back of the lines than at the front or at home. The interdiction of alcohol during mobilization certainly reduced the incidence of circulatory disturbances. Even later its use was not marked by excesses. Seldom was there any opportunity for excess. Alcohol is a real poison to the vessels. The peripheral vessels dilate with large doses, whereupon the heart must work harder in order to compensate for the ensuing fall of pressure. Direct stimulating effects of alcohol upon the vasomotor centers are also recognized. Alcohol influences the cerebrum, according to Dixon, and also excites the vagus center. Large doses reduce the contractility of the heart; small doses tend to stimulate it. According to Bachmann, the coronary vessels are dilated by alcohol in small quantities. The effects of alcohol vary with the amounts taken and with the susceptibility of the individual. Large amounts cause a lowering of blood pressure through general widening of the vessels, and small amounts cause a heightening through constriction. As a rule cessation of the use of alcohol is followed by disappearance of symptoms. The rare cases of circulatory disturbance due to alcohol were quickly relieved in the hospitals, and the difficulty in procuring strong liquor, especially at home, led to the substitution of a weak drink for the beer known as the "German national beverage." Wine reached unheard-of prices, spirits were rare, and those who were accustomed to seek their diversion in alcohol were denied the opportunity. There are very few accounts in medical literature of the influence of alcohol on the circulatory system of soldiers.

Although we have no collected individual experiences concerning the effect of misuse of alcohol, many authors are of the opinion that it worked together with tobacco in the production of so-called nervous circulatory disorders. This is emphasized by Plehu, His, Wencklebach, Steyrer, Eh Schott, Erdelyi and others in their references to the influence of alcohol and tobacco in the production of cardiac disorders in soldiers. The effect of alcohol is especially emphasized by Lennhoff, who made his studies in the eastern field of operations.

The misuse of alcohol in the early part of the war, and especially in the west, was only sporadically encountered in units lying far back of the lines. That the misuse of alcohol occurred among those kept in hospitals at home for a long time because of wounds and sickness hindered their restoration to duty was reported many times, especially early in the war, and was confirmed by me through occasional visits to these hospitals.

The circulatory disturbances consisted clinically of tachycardia, vasomotor disorder and the occasional symptoms of alcoholism which,

on the side of the nervous system, consisted chiefly of tremor of hands and tongue and psychic alterations for the most part of a depressive nature. The minor rôle which alcohol played in general in the production of heart disorders is confirmed by the observation of psychiatrists that alcoholic insanity grew constantly rarer in the institutions (Peretti).

The misuse of tea and coffee was also only occasionally observed as causes of functional circulatory disorders. Since caffein and theine have their point of attack in the vasomotor centers, they tend to contract the vessels, but only through sympathetic innervation. The coronary arteries, for example, do not contract, as they are served by the autonomic system. They stimulate the heart muscle, partly through the altered distribution of blood dependent on their influence upon the vessels (Dreser). Since tea and coffee are seldom provided in large quantities, disorders due to them are not often observed.

More important is the injurious effect of quinine on the heart. In many places quinine had to be given as a prophylactic to check malarial infection, and in addition a great deal of it was used therapeutically. Plehn mentions disturbances due to this drug. I have not recognized any such disturbance myself, but it is only reasonable to suppose that, in places in the field where quinine must be used in large quantities, occasional disorders due to its use would be encountered.

So far as concerns the other circulatory poisons, such as atrophin, digitalis, physostigma, strychnine and ergotin, there is only the question of occasional poisoning which is scarcely mentioned in the literature and which I have never encountered.

B. Circulatory Disturbances through Effects upon the Cardiac Nerves.—Disturbances of circulation through organic lesions of the cardiac nerves or of their places of origin are only occasionally reported. Schott reported tachycardia following wounds high in the cervical cord, which he could also demonstrate experimentally and which was attributed to increased vagus tonus. Wounds of the vagus, usually unilateral, were often encountered in gunshot wounds of the chest and were discussed under this classification. Circulatory disturbances following them were seldom observed. Unilateral wounds of the vagus had no permanent sequels, as a rule. Transient tachycardia sometimes occurred but seldom reached a high degree. Special treatment was not needed. It is theoretically possible to have disturbances due to wounds of sympathetic fibers in the cause of the accelerators, but practically we have no experience along this line. Concerning the part played by the nervous organs situated in the heart itself after possible penetrating wounds, of which a great number are reported by Kienback, Huysumanns, Schutze and others, nothing is known. Two cases which I

investigated, in which a bullet was imbedded in the heart wall, showed no functional disturbance of the heart itself, at least no tachycardia or arrhythmia. Koetzle reported a case of gunshot wound of the heart which exhibited heart block with a pulse of 40 due to injury to the conduction.

C. Circulatory Disturbances as Symptoms of General Neuroses, Constitutionally and Reflexly Conditioned.—The functional disturbances which, as experience showed, occurred as symptoms of general psychoneuroses, were especially important both because of their frequency and because of their effects on military efficiency. It was these that attracted the attention of most of the authors who have written on circulatory disturbances in soldiers. During the early part of the war the conception of these disorders was various. Although many looked upon them as psycho-neurotic effects upon the heart, as symptoms of general nervousness, being only in doubt as to whether purely physical influence had produced them or whether the psychic component was the prevailing one, others postulated an organic origin. Not every circulatory disturbance produced through the nervous system alone or accompanying a nervous disturbance is to be looked upon as a neurosis. There are circulatory disturbances due to the influence of the ductless glands, especially the thyroid, and although these operate in part through the nervous system we do not speak here of a neurosis, because removal of the cause also removes the disturbing nervous influence.

On the other hand, certain changes in the heart efficiency are produced by altered function in the so-called "specific muscle tissue" of the heart. This last probably closely resembles nervous tissue in its function. We do not wish to discuss here the question whether the heart works myogenically or neurogenically. There is no doubt, however, that the places in the heart where we find this specific musculature and which are especially rich in ganglion cells are of great importance to the undisturbed working of the heart. Furthermore, it is certain that the impulses from the brain which are conducted normally by the cardiac nerves strongly influence these places and that they are the chief working centers of the cardiac nerves. Although we cannot call disturbances produced through altered function of this tissue neuroses, nevertheless nervous influences often seem to produce them. These disturbances may best be regarded as functional. They are arrhythmia, tachycardia and bradycardia. The results of experimental physiology and pathology bring us more and more to the conclusion that irregularity of the heart should be regarded solely and separately as a disturbance of function of this tissue. Such disturbances can be produced organically; for example, through disease a destruction of the conduction system

of specific muscle tissue lying between auricle and ventricle, which has its origin in the nodes of Aschoff-Eawara, passes through the muscle bridge of this to the fibrous ring separating auricles and ventricles from each other and leads to excitation of both ventricles through the bundle of Eawara.

The second place where this musculature can be demonstrated is the sinus node of Keith-Flak, which is situated at the opening of the superior vena cava into the right auricle. Normally cardiac excitation proceeds from here, and from here coordinated beating is determined. Nervous influences acting on the sinus node quicken or slow the heart without disturbing the coordination of the individual cycle.

However, when the specific musculature in another place overweighs the nodal impulses governing frequency or, what is more probable, interfering impulses are produced, we have irregularity of the heart beat, usually extra systole or the premature occurrence of a contraction in the midst of the normal rhythm, the impulse coming from an abnormal place. Accumulated impulses of this sort which entirely shut out the sinus rhythm lead to heart-racing, the so-called paroxysmal tachycardia.

Disturbances in the conduction system lead to dropped beat or, if they lead to complete interruption, to permanent ventricular rhythm, a high grade *tachycardia* of about 39 to 49 beats to the minute. Here, according to H. Straub, the disturbance can also be explained through lessened capacity of the contractile musculature.

A very frequent disturbance of rhythm is auricular fibrillation, in which the auricles no longer contract rhythmically but show very rapid and tremulous movements. A slower form of this disturbance is auricular flutter, in which the auricular contractions follow each other very rapidly. Both are recognizable only through the electro-cardiogram, although it can be determined clinically that the ventricular activity is very irregular and the pulse entirely so with no recognizable rhythm.

The circumstance that irregularities of the sort described occur in hearts anatomically sound and unsound, in myocardial disorders, absence of heart sounds and other conditions which are proven organic give them a unique place among circulatory disorders. They are functional disturbances which are produced through nervous impulses both experimentally and in the human subject, and the fact that they often occur in organic heart disorders can only be explained by recognizing that the condition of the vital organs, in this case the heart, is largely dependent on nervous influences. Vagus research has especially taught this.

Experiences of the World War show that cardiac irregularity, especi-

ally extra systole, can be produced through nervous and mental influences, but this was already known (A. Hoffmann, Kenkure). Shurmann has observed neurasthenic soldiers during grenade fire and has witnessed great increase in pulse frequency, and the onset of extra-systole conduction disturbances can be brought about through stimulation of the vagus; for example, auricular fibrillation (Ritchie and A. Hoffmann). The latter can be overcome among other means through vagus influence, and the same is true of heart-racing. Arrhythmias are often seen as psycho-neurotic complications of existing circulatory disturbances, but in these cases there is extreme lability of the specific musculature. Cardiac irregularities separate themselves from psycho-neurotic disturbances as peculiar functional disorders, and their occurrence is to be looked upon as a complication.

The etiology of nervous circulatory disturbances is various. They are often seen following severe physical exertion, after forced marches, continuous hardships during which there was limited opportunity for sleep, after prolonged fighting with little chance for rest, and in this connection His speaks of tired heart. It has also been noted in time of peace that loss of sleep, coupled with great physical exertion and excitement as sometimes occurs in sport, can produce circulatory disturbances. Here we see tachycardia coupled with general nervous disturbances Considering the physical exertions of soldiers it is to be borne in mind that they were performed under circumstances of great psychic drive and strain. The constant danger to life, the tension put upon all mental and physical powers, the uncertainty of the issue and sequent circumstances, all this worked together psychically with the physical strains. It is the same in sport. We have here also a marked participation of the psychic elements. It must also be borne in mind that in war these exertions were often made by people quite unaccustomed to them. Leaving out of account the regular military personnel who had received extended training and a few sportsmen, the others had been wrested from their usual domestic occupations and, except for the day laborers, they were not accustomed to hard physical work.

It is a well-known fact proven experimentally by E. Weber that an accustomed, well-learned activity proceeds with much less mental strain than a new and unfamiliar one. Although during an accustomed activity the muscles work almost automatically, during an accustomed one the brain must take a much larger part. The individual must pay attention to what he is doing. Accompanying the participation of the brain is the participation of the circulatory organs, which are more active during unaccustomed than during accustomed work. That the physical goes along with the mental component in such cases has been

emphasized by Magnus-Levi and Pick. The increased demands for blood on the part of the muscles cause the blood to return to the right heart in larger quantity and faster. In order to meet the increased demand the right ventricle becomes fuller and increases its frequency of contraction. Correspondingly more work must be done by the left ventricle as the blood streams faster to it through the pulmonary circulation. Heightened exertion brings increased filling and increased frequency, but a sound heart is able to accomplish this, although it can eventually reach a state of fatigue and can also become stronger through activity and exercise just as the general musculature can (Dibbelt). Here comes into play the influence of the arterial system. Vasoconstriction causes heightened resistance and vasodilatation the opposite. This of course influences the work of the heart.

Here also arises the important question of enlargement of the heart among soldiers, which was minutely studied by Wenckebach and Kaufmann, Moose, and Zondeck, Dietlen and others. Among a great many examined it was found, although not with exceptional frequency, that after long military service the Roentgen heart shadow was enlarged. A small proportion of these showed a lessening of heart activity, and in such cases, by the use of therapeutic measures, the heart could be reduced in size (Kaufmann). In most cases, however, it was necessary to strengthen the heart muscle. Some of these latter cases showed no symptoms and some showed rapid and irritable hearts. Aside from overexertion, there arose in these cases the question of acute and chronic diseases. Circulatory disturbances were common after typhus or typhoid and not at all infrequent following wounds and diseases of the stomach and intestines. From the experience of peace time we know enough concerning the bad effect of typhus on the entire nervous system. That these effects showed themselves often in the field is not surprising. Here myocardial injuries can show themselves but are not the rule, the general condition and especially the nervous component having most to do with the circulatory symptoms (T. Groedel). The same is true of the enervating influence of former infectious diseases, as well as diseases of the stomach, bowels and other organs. Paessler mentions the etiologic significance of mouth infections in the production of circulatory disorders. This is not frequent, however. With the wounded it was noticed, among other things, that they came into the hospital without circulatory disturbances, but began to show them as convalescence progressed and the danger of return to the lines drew nearer.

Most of these suffering from functional circulatory disorders gave a history of either overexertion, wounds or an infectious or exhausting disease. In these cases only psychic factors could be determined as

causes. Ehrmann's observations in grenade fire have already been cited. Other authors have also made observations of circulatory disturbances following great mental excitement. I myself saw, in field hospitals at the beginning of the war, many patients complaining of heart disorders after fighting and presenting pictures which I have described more in detail farther on. These cases were especially frequent, however, in the home hospitals, where I had an opportunity to examine a great many of them. On account of the prevailing uncertainty concerning the significance of these conditions, especially at the beginning, they were sent with little delay to the hospitals in the interior and there great numbers of them accumulated. In the military hospitals just back of the lines they were not so numerous, though some were found.

As many authors besides myself—for example, Plaut and others—have observed there were in the hospitals at home many with circulatory disturbances who had never been in the field, who had been in the service only a short time, had had no training and who had no history of overexertion or fatigue to explain the symptoms which were smilar to those described. All showed the psychic effects which are encountered also in peace times on mustering into the service. The fear that the military service entails great exertion causes many, especially if they are none too strong in constitution, to doubt whether they are capable of such exertion or whether it will prove to be too much for them. These psychic influences are still more operative during war, when the danger and the unaccustomed hardships are greatly feared. There is also homesickness. Many are weighed down by the fact that they can scarcely bear to leave their accustomed surroundings, others by fear of economic losses, and so it comes about that among recruits there are a great number with circulatory disturbances due to psychic causes. Life in the field brings homesickness and the undue psychic stimulation accompanying and following great exertion and fighting. Add to this the painful impression made by the losses sustained on the remaining troops, the impression of the killed and wounded and the many other influences, not to be enumerated individually here, which have an adverse psychic effect. Naturally, not all are affected by these and not all react with cardio-vascular symptoms. What here gives the decision is for the most part not only the physical but also the psychic constitution. There is no simple scheme for this. I have seen giants who broke down nervously with their hearts and delicate, slender figures who showed no circulatory disturbance in spite of frightful experiences and great hardships. In this connection the previous occupation was important. Mental workers and light workers in

general showed a high percentage of nervous circulatory disorders. It is not to be denied that a certain congenital or acquired predisposition was present in most, as it developed from the histories that nervous disorders were present in the families of many, and in many cases questioning brought out the fact that they themselves had formerly been nervous. Thus exceptional disposition, mental and physical makeup, psychic and physical influences of military life all worked together to make such individuals sick.

D. Symptomatology.—The clinical picture was not the same as all these cases of circulatory disturbance if it showed a certain conformity so far as the heart was concerned. There occurred the general picture of hysteria and neurasthenia just as in other functional neuroses which rest on a psychic basis. Among these there were observed, it is true, certain types, but on the other hand a great variety of nervous manifestations, especially in the field of motility and sensibility. It is not appropriate here to paint the picture of such general neuroses, but, for the most part, only the circulatory symptoms which were observed in them.

The subjective symptoms complained of in connection with the heart varied much in severity. Many simply "felt their hearts"—that is, they complained of uncomfortable sensations, weight and pressure in the left side of the chest. These were especially the cases accompanied by a diagnosis of heart disease and who were now constantly directing their attention to the cardiac region. Besides this feeling of pressure there were often paresthesias complained of, crawling and drawing sensations in the region of the heart and thumping. In addition there were often general nervous complaints, such as headache, feelings of faintness, of anxiety and general depression. Sleep was often disturbed. Dyspnea was seldom complained of, but the patients often said they got short of breath under exertion or excitement. One of the principal complaints was loss of mental and physical efficiency. They tired easily, could not exert themselves much, and were easily excited. There was only rarely a history of acute articular rheumatism, and this simply led to an unusually searching examination of the heart. Oftener there had been wounds, acute or chronic diseases, especially of the stomach and bowels, also typhus, bronchitis, during or after which the heart symptoms appeared. The abuse of alcohol and nicotine was less frequent. Sometimes the patients complained of pain in the region of the heart. However, this was usually not localized under the sternum as in true angina pectoris, but rather in the vicinity of the apex of the heart. It did not often radiate to the left and was usually not of great severity, was not increased on moving and did not hinder locomotion. It did not occur in the form of nocturnal attacks.

The frequent shortness of breath as a rule did not show itself as an objective symptom. To be sure, breathing was quickened more or less by excitement or exertion, but the action of the auxiliary breathing muscles observed in true dyspnea was lacking, as well as the movement of the alae of the nose and the striking cyanosis. Often this difficulty in breathing was purely subjective, with no quickening of respiration, but rather a slowing and deepening. In a few cases there was seen quickened and shallow breathing with superficial movements up to 100 in frequency accompanied by the customary breathing in slow draughts. I have seen this in three cases in which the superficial breath movements were taken for heart movements and the accompanying respiratory murmurs. The simultaneous observation of the pulse proves the incongruity of the murmurs with the heart action.

The objective symptoms were various. The physical constitution was not uniform. To be sure there were many cardiac neurotics who showed an asthenic habitus (Stiller), some poorly nourished and over grown (F. Kraus), but on the other hand these were also individuals whose physical makeup could not in the least be regarded as inferior. The musculature corresponded to the constitution. For the most part, there was little development of fat in these patients, yet quite a number, especially the older ones, had rather fat bodies.

The thyroid showed no abnormal enlargement, although in young individuals it was often visible and palpable. Staring eyes and marked exophthalmos were not observed.

The skin color was varied, but both skin and mucous membranes were usually pale. The percentage of hemoglobin varied, but the blood picture was normal. There was often great vascular irritability which showed itself in mottling of the upper breast parts. Pronounced demography was more rare.

The condition of the nervous system, so far as it could be investigated, objectively, was not uniform. Fluttering of the lids, tremor of the tongue and of the outstretched hands were especially frequent. There were no other motor disturbances but there was often unsteady station with eyes closed as in other nervous conditions.

Sensation was sometimes intact, but on the other hand there were sometimes anesthesias or paresthesias, whose distribution was either radicular or corresponded to some particular nerve. The tendon reflexes were often lively without showing any pathologic increase and were often quite normal. They were not uniform throughout. Gait showed no disturbance.

On examination of the heart the dulness varied, but showed no pathologic increase in most cases. According to the Roentgen pictures,

these cases showed all possible shapes and sizes of hearts within the normal limits. His has already emphasized the fact that the shape of the heart shows nothing characteristic in such cases. Von Dietlen's normal figure was sometimes exceeded and, as Wenckebach emphasizes, such slight excess is not to be regarded as a pathologic increase in size. The size is dependent on body size, on weight, on shape of the thorax, and especially on the position of the diaphragm. There was often found a narrow heart shadow in long, narrow chests, which has been designated as drop heart (F. Kraus). On the other hand, especially in older individuals, with a high diaphragm, there was found a transverse lying heart (duck-shaped). Between these two there were all possible variations.

The apex beat was placed in correspondence with the size and position of the heart. Especially when the heart action was rapid it was often conspicuous and lying medial to the left nipple line. For the most part it was circumscribed and moderately forcible to the touch. When great increase in size of the heart occurred there was usually muscular disease of the heart or vascular or kidney disease.

Much has been written concerning the significance of the enlargement of the heart in soldiers. It is necessary to distinguish between a healthy hypertrophy of the heart muscle induced by exercise and going along with a general strengthening of the muscles of the body (strong heart) and a dilation due to weakening of the contractile power of the heart muscle (tired heart). Although the former caused no trouble, the latter sometimes led to circulatory disturbances, not necessarily with the tachycardia. When it did occur in such cases there was, as a rule, an overlying with nervous symptoms. It was also found that cases which under other circumstances would show hypertrophy or dilatation exhibited nothing except tachycardia; that is, if they had not been subjected to conditions which would create a serious circulatory disorder. In this connection the differentiation between muscular insufficiency and neurosis is not so difficult as it has often been represented to be. It must simply be remembered always that organic diseases can be overlaid with functional ones.

The importance of Roentgen investigation has been amply proven in the hearts of soldiers who complain of cardiac disorders, and it should always be employed in doubtful cases, remembering that we must not speak in terms of millimeters and bearing in mind the form of the heart shadow, which nearly always show some deviation in organic cases. Maase and Zondeck, F. Grodel, His, Wenckebach and many others have strongly emphasized this. Certain it is that the symptoms complexes observed in cardiac neuroses do not rest on enlargement of

the heart and do not need to be bound up with myocardial disease. The explanation was already at hand for the findings of Zehbe and F. A. Hoffmann.

The alteration of heart action is the most conspicuous symptom. This was nearly always quickened, seldom normal, and still more seldom slowed. When there was marked slowing an organic disorder was suggested; at least this symptom was most often found after some enervating sickness such as an infectious disease. When the heart action was normal the circulatory symptoms narrowed themselves down to purely subjective sensations. The quickening of the heart action was such a frequent symptom that some authors named the entire symptom complex on this account. They called this disorder "Herzklopfer." (It is doubtful how this should be translated, but it may be taken to mean violent pounding or beating of the heart.) The degree of quickening varied and, looking back, it proved to be of diagnostic interest and significance. In the mildest cases the pulse was from 90 to 110 at rest and quickened with movement, the best exercise being from 5 to 10 genuflexions, up to from 120 to 130. The quickening usually lasted longer than two minutes and returned to normal slowly. It proved fallacious to make a diagnosis of organic disease on account of prolonged quickening of heart action, because in cases where quickening was produced by psychic excitement the pulse returned slowly to its original frequency after exercise.

Those cases were considered moderately severe in which the pulse frequency was from 120 to 130 at rest and increased to from 140 to 150 by exercise. In these cases the increase was often more persistent. It must always be remembered that, when physical exercise such as stooping is taken for the purpose of judging the nature of a heart condition, it is accompanied by a certain degree of mental excitement and cannot be regarded as a purely physical test. The patient knows that he is being examined and that much depends on the result of the examination, thus bringing in a mental component to be added to the physical.

Those cases were classified as severe in which the pulse rate at rest was 140 or more. Often in such cases the pulse was not further quickened by exercise, indicating that the greatest physiological frequency for the individual had already been reached. In rare cases a frequency of 160 or even 180 could be reached through exercise. Sometimes, however, this highest possible frequency has already been reached at rest.

Examinations standing, lying and sitting, as employed especially by F. Grodel, sometimes showed differences and sometimes none, so

that this kind of a test did not prove to be of conclusive significance. When patients were in bed in hospital the pulse was slowed, also during sleep, and repeated counts made at regular intervals during the day by attendants gave the same result so that often the charts showed scarcely any evidence of tachycardia. This was true of the mild and moderately severe cases, while in the severe ones there was persistent frequency, though usually with slight modification.

The behavior of the pulse with respiration varied. The milder cases showed no particular deviation and some prognostic significance could be attached to this fact. With high frequency the ratio varied, but the variation seen in some cases was not of definite significance.

The heart action and the pulse were usually regular. Graphic examination showed normally coordinated heart action. Auricle and ventricle contracted in normal sequence. The systole is sometimes shortened also (H. Straub) but in less degree than the diastole. In rare cases there were arrhythmic disturbances, especially extra systoles, which broke singly into the regular heart rhythm. Arrhythmia may be regarded as an unusual complication in these cases.

Occasional cases with regularly occurring extra systoles do not belong here. Like all arrhythmias these are functional disturbances, in which there is altered function of the specific tissue of the heart. In such cases there is seldom any tachycardia, at the most a little quickening of the heart action. The cases with auricular fibrillation or conduction disturbance should be set apart as complications. They seldom rest on a functional basis. My cases of extra systole were all between twenty-eight and thirty-three years of age. Many of them gave a history of over-use of tobacco.

As a rule the heart sounds are pure. Non-organic murmurs were frequent, and Wenckebach found them in 40 per cent of the cases, others less frequently. Although the first heart sound was often impure in severe tachycardia, the second sound was usually pure. All causes assignable for non-organic murmurs were operative in these cases. Cardio-respiratory murmurs were frequent. The quickened heart action may bring it about that the valves do not close as sharply as normal. The scantily filled ventricles, having less blood than usual on account of the shortened diastole, do not force the valve leaflets so completely and promptly together but that a small amount of blood can leak back into the auricles. The result is the same as in the functional mitral insufficiency of Krehl. On account of the rapidity of action the muscular closure of the auriculo-ventricular openings is less complete. This rapidity also favors eddy formation, and so does a certain degree of anemia which is also present. Kylin found a strik-

ingly high percentage of functional heart murmurs among soldiers apparently with sound hearts who were taken out of the service on account of circulatory disturbances. He thought this should be looked upon as an indication of ventricular insufficiency.

A peculiar murmur heard over the base of the heart attracts particular attention. This is a rough systolic murmur, often scratching or scraping in character, which is sometimes heard in the pulmonic area or over the entire heart. It usually disappears entirely with deep inspiration and becomes distinct on complete expiration. The scratchy character of this murmur, which is analogous to the pulmonic murmur of Luthje found in children, has been explained on the theory that it is a friction sound arising from the fact that on expiration the anterior wall of the heart approaches the chest wall (Haenisch and Querner). It may be, however, that torsion of the pulmonary artery produces the same effect. It has no pathological significance. In Roentgen examination in such cases it is often seen that the lung field anterior to the heart is diminished and, on expiration, completely disappears.

The definition of the heart sounds is usually normal. In spite of the rapidity of the heart tbe first and second sounds can readily be distinguished from each other. There is an absence of so-called embryonal or pendulum rhythm. It is sometimes noticed that the second sound at the apex is stronger than the first and often the sounds are very brusque and clear cut, so that one gets the impression of an abnormally quick and sharp contraction. No alteration in the electro-cardiogram can be distinguished except a slight shortening of the ventricular contraction point.

The pulse is usually small and soft, corresponding to the lessened filling of the arterial system at each systole.

The blood pressure is not uniform. In most cases both the maximum and minimum were normal. In many cases it was lower than normal and occasionally higher. Vollmer attached much significance to blood-pressure measurement in these cases, but many examinations in my experience have shown that the blood pressure is constantly changing, that it is sometimes increased only to be normal or lower than normal in a few hours. Plehn, who is inclined to make a decreasing tone of the blood vessels responsible for the onset of circulatory disturbances in many cases, looks to the vasomotor system for an explanation of the trouble. Undoubtedly psychic excitement affects the vascular system along with the rest of the body. Heart and vascular system are alike affected by psychic influences, the heart through its regulatory system as well as the vessels. In one case the vasomotor influence will predominate, in another the heart influence, and it is hard to separate the two.

There are no characteristic findings in the other organs. The digestive organs were usually not seriously disturbed and, when they were, the disturbances was nervous or mental in origin and not due to any changes in the circulatory system. Anorexia, diarrhea and constipation were frequent. Anomalies of secretion and motility could be explained through nervous influences. The liver was not enlarged and showed no signs of congestion, the same being true of the spleen. Albuminuria was not observed and micturition was normal. Sometimes the urine was persistently pale and of low specific gravity. There was no congestive catarrh of the lungs in these cases where a complicating bronchitis was absent. Especially was there an absence of the typical posterior basal catarrh. There was no edema. Sometimes there were painful swellings of the joints of the feet, but these cases were not due to impaired circulation but rather followed prolonged inactivity, as in convalescence from typhoid. There were no signs of circulatory insufficiency.

Concerning the numbers of these cases I have made occasional investigations in the home hospitals of certain corps areas. On a corps area with 38,770 beds in reserve and fraternal society hospitals there were on August 1, 1915, 1,576 of such cases and 1,617 on August 1, 1916. Of these I examined 998 in the first lot and 921 in the second. Among the 998 examined in August, 1915, I regarded 177 as organically diseased and 819 as functional. Among the 921 examined in August, 1916, I thought 133 were organic and 772 functional. Of 3,150 examined by me in different corps-area hospitals and of which I have records, 521 were organic and 2,613 had nervous heart disorders. It appeared that there were about five times as many nervous cardiac cases as organic ones. In these two groups the relative proportion was about the same. Among two of the cardiac neurotics 86 showed a pulse frequency of from 100 to 110 at rest, 352 showed from 110 to 120, and 92 had a still higher rate. The moderately severe cases were in the majority. I have classified 1,156 of the neurotic cases according to age. Of these, 32 were under 20 years, 718 were between 20 and 30, 360 between 30 and 40, and 46 over 40. According to occupation 1,103 such cases were classified as follows: Brain-workers, 353; light indoor workers and shop workers who were not accustomed to great exertion, such as barbers, waiters, shoe-workers, tailors, etc., 355; heavy workers only 193 and farmers 202.

It appears from this enumeration that the great majority of cardiac neurotics were in the younger age groups, a period at which organic circulatory disorders are not very common, leaving out of account the defective hearts, which are easily distinguished. Arteriosclerosis, in

spite of the findings of Monckeberg, plays no rôle as a progressive disease in these age groups, and the same is true of myocardial degeneration, which under certain circumstances is hard to distinguish from functional disorder. Kidney and other diseases were easily diagnosed and differentiated. The age was in favor of a functional disorder of nervous origin.

My occupation statistics show that light workers, such as brain workers and indoor people in general, formed by far the greater proportion of the sick, which indicates that lack of training and exercise and marked participation of the psychic component in the necessarily great physical effort were real factors in producing the disorder. The strikingly great number of farmers can perhaps be explained by the nature of the occupation, which is essentially peaceful and makes light psychic demands in contrast to the frightfully heightened effect of modern technical warfare. The heavy workers, who form the smallest contingent, are on the one hand less sensitive to great exertion and hardship because of their customary activity and are, on the other hand, more adjustable to mechanical warfare. To be sure it must be borne in mind that relatively few heavy workers were taken into the service because of the desire to maintain the efficiency of munitions and other war industries.

The prognosis of such psycho-neurotically induced circulatory disorders is of great importance on account of judging them after the end of the war. It is a striking fact that these cases become constantly rarer. Even during the war they were rare in prison camps, and after one year of peace the severer forms are seldom seen. During the war the lighter forms usually cleared up with a few weeks of rest and diversion, while the moderately severe cases required a longer period of care and treatment. The most severe, those with the highest pulse frequency, who also usually gave pronounced signs of general nervousness, were the most stubborn, and these come up occasionally even now for pension examinations. But even among these it is to be noted that for the most part in the course of a few years, especially if they are not overworked in their accustomed occupation and are not subjected to care and worry, they return to normal so far as is possible considering their original nervous condition.

It should be borne in mind that, when unfavorable economic conditions obtain, the granting of compensation to such neurotic persons tends to bring about fixation of their complaint. The whole trouble is nothing but a fixation of disorders which can be created in sound men by severe psychic shock and especially easily in neurotic ones. Great psychic excitement produces similar symptoms temporarily in

healthy people, especially if coupled with great physical exertion, such as tremors, palpitation and, in psychopathic people, emotional depression or excitement. The observation had been made in the past that after great catastrophes, such as the Messina earthquake, many people were found with similar psychogenic heart disturbances.

Furthermore, the prognosis depends a good deal on whether the patients were previously nervous; for example, had functional circulatory disturbances, or whether they became so only on account of special circumstances. Among these soldiers whose trouble depended on some particular experience, such as being buried, shocked by grenade explosions, or some other trying event of battle, the symptoms usually cleared up faster than in those who had not undergone such severe experiences. Among those examined in the home hospitals there were many who had never been marched out. In one hospital I found, as against 149 whose symptoms arose in the field, 40 who had never reached the field and whose circulatory symptoms had already begun while they were undergoing training. I found further that most of the 40 had become ill during the first two months of service, in fact 35 of them, and only five after three or four months of training. Among the 149 field patients examined there I found that 60 fell ill in the first three months of field service, and 76 within the first five months in the field. Among the last were more particularly those who could trace their trouble back to some particular experience. From this enumeration it appears how important the predisposition must be, the vulnerable nervous and mental make-up. Such people fail with the first trying experience, and so it would be of the greatest advantage if one could in the beginning cut out these elements worthless for military service, but this would only be possible by searching investigation of the previous history and of the individual make-up.

Besides the foregoing clinical picture, which is to be looked upon as part of a general neurosis, although the circulatory symptoms were often so conspicuous that the other nervous complaints were often regarded as secondary, something that gave occasion in time of peace for certain authors to look upon the heart disturbances in neurotics as primary and the nervous disturbances as dependent on the heart disorder, a view which is occasionally encountered even now, there were seen a few pictures which are even now regarded as true circulatory neuroses. Among these we have the occurrence of "heart racing." This had already been mentioned in discussions of cardiac arrhythmias. It is seldom mentioned in the medical literature of the war, but I have seen seven attacks in three different persons. Contrary to the neuroses it should be looked upon as a functional disturbance due to some dis-

order of the specific muscle tissue of the heart. Since these patients have no circulatory symptoms in the interval and show no signs of general nervousness, it is conceivable that many with this affection were inducted into military service, the condition upon investigation being found to be not so rare as had been generally supposed. Such persons have usually stood the training well, and I have met them in the field. That the physical and mental hardships of war aggravate the attacks cannot be proved, assuming that the patients have otherwise sound hearts. On the contrary, at the beginning of the war I met two officers suffering from attacks of tachycardia in whom the attacks were becoming less frequent. Service at the front is scarcely suitable for such a condition because the attacks render the patients entirely helpless for the time being, but garrison duty was found to be all right. For the most part the patients know, or soon find out, how they can cut short the attacks, which works promptly in many cases, but in others the attack continues for some time, only to end suddenly and be succeeded after a few hours by a feeling of complete well-being. Since it seems certain that the attacks consist of heaped-up extra systoles they are to be distinguished from the cases showing extra systoles regularly interpolated into the heart cycle. Such, in the cases observed by me, come as a rule with each third beat, so that a sort of "trigeminy" exists in which the first two beats indicate normal heart activity and the third constitutes an extra systole. The electrocardiogram, when I have been able to employ it in such cases, has shown regular auricular extra systoles in which the auricular point P, during the extra systole, shows a figure like the normal systole in Figs. 2 and 3. The extra systoles disappear for a time with exercises but come back during rest. This is also a functional disturbance, but uncomfortable for the patient because it is so often accompanied by abnormal sensations, and these cause the patient to be always thinking of his heart. These cases also were unfit for service at the front, but could be employed at light duty.

I have seen transitory conduction disturbances in patients with acute articular rheumatism in hospitals, but these were only temporary. It is probable that we have myocardial trouble in such cases—for example, disease of the specific cardiac muscle tissue—and the greatest care must be taken to insure their convalescence. The disturbance disappeared completely after a few days or weeks. Persistent conduction disturbances, which always have an organic origin, I have seen in only a few cases in elderly officers, and these in home hospitals where they were held because they were useless at the front on account of their condition.

I found auricular fibrillation only in patients with organic trouble, especially often with mitral insufficiency. They were set aside on that account. Pulsus alternaus, when it was observed, was also an accompaniment of serious heart insufficiency.

E. Therapy.—The treatment of nervous and functional heart disorders necessarily varies according to the degree of the disturbance, its duration and the general condition of the patient. In those cases in which the circulatory disturbance was brought on by some specific occurrence and in which the patient was previously sound, it was usually sufficient, as I have already said, to place him for a time in a hospital or convalescent home. In a few weeks, as a rule, rest would result in great improvement and restoration of sufficiency. Such patients needed, first of all, rest and then graduated exercise to restore them to activity. Too long rest was not indicated; on the contrary, it favored fixation of the complaint. When the tachycardia cases persisted in spite of long treatment in field hospitals or convalescent homes, there was nothing left but to put them in home hospitals. This was true of those with disturbances resting on a general neurasthenic basis. Such men who were already very nervous were made neurasthenic more and more under the influence of military life, and at various times in field hospitals during maneuvers I have seen patients who had been treated without success for eight or more weeks. The nearness to the front, airplane attacks and such kept up the excitement, and so, as a rule, in such cases there was nothing to do but to send them back and employ them in some other way after their condition has improved.

One unfortunate circumstance was the fact that at first these patients were sent to places which were unfavorable for them, placed among wounded, often lightly regarded and perhaps over-zealously treated. In Austria, on this account, heart stations and heart hospitals were established; and also, with us, these patients were sent, so far as possible, to such places where doctors especially skilled in internal medicine and in neurology were on duty.

The treatment of neuro-psychiatric cardiac patients did not differ materially from that of other neurotics but did differ from that of organic patients. Most important was the psychic treatment. One difficulty arose from the fact that while in neurasthenic and hysterical cases the symptoms lie mostly within the field of voluntary innervation, here there was little to be accomplished through direct action of the will. The innervation of the circulation is from the autonomic and sympathetic systems, which are not immediately under the influence of the will but which can be influenced indirectly by means of ideas or mental

pictures, as shown by prior observations; for example, those of Tarchanoff, who demonstrated that by practice through such means the pulse could be quickened or slowed to a certain degree. This is the psychic means to be employed. It requires the constant attention of the physician and, above all, the combating of any harmful auto-suggestion on the part of the patient that he is really sick. The imparting of a diagnosis of heart trouble in such cases has done a great deal of harm. Once he has been persuaded that he has heart disease, he feels that he really has and is much more refractory to psycho-therapeutic counter-suggestion. The unfortunate postulation of cardiac enlargement or heightened blood pressure—neither is a diagnosis—has wrought much evil in these cases and the assurance that there is nothing wrong with them or their hearts often makes the patients laugh immoderately. They were too thoroughly convinced of the contrary to be easily persuaded otherwise. Psycho-therapeutic treatment makes great demands on the physician and the attendants. It is much harder with these cardiac neurotic to create the proper atmosphere for a cure than with hysterical cases in whom a few cures by suggestion (the other author uses the term "Wunderkuren," literally "wonder cures") make the rest of the patients much more receptive. Nothing is to be gained by brusque handling; other means must be employed here such as earnest persuasion supported by corresponding general treatment.

There is no doubt that psychic treatment, which is the mainstay, can be carried out better in certain establishments, but, on the other hand, if the neurotic cases go to resorts much frequented by organic patients, the association is likely to make and to maintain ideas and suggestion that have an unwholesome effect.

Among cure resorts are first to be considered those with carbon dioxide springs, as emphasized by Wenckebach. No specific effect of these baths on the neurotic is to be observed, some being favorable and some unfavorably influenced by the strenuous bath procedure. The principal effect of such baths lies, next to the psychic effect, in the temperature of the water, and since the thermic stimulus acts not only on the circulatory organs but also on the entire nervous system, and the latter effect is not to be depreciated, hydro-therapeutic treatment is often of benefit in these cases. Here we must proceed slowly and cautiously, only gradually decreasing the temperature and increasing the length of the treatment. An incautious application of baths in such cases is always harmful.

Instead of carbon-dioxide oxygen and air-bubble baths can be employed and these differ little in their effects. Baths with the addition of pine-needle extract, a sunlight, also hydro-electric baths, are

often employed with varying effect. How effective radio-active substances are is undecided. Suggestive influence plays a great, if not the chief rôle, in all these procedures for this class of patients. How much psychic influences help to fortify such cures was already well known in peace times.

Moderately high altitude, even high altitude, is often beneficial, and especially the restfulness and the wooded character of the surroundings. Too long rest is not, however, to be recommended. I have seen no benefit from protracted bed rest; on the contrary the patients become more apprehensive and more certain that there is really something wrong with them. They must be got back as soon as possible to activity by means of light exercise. The demands on the musculature must be systematically increased, and this produced the happiest effect in the cases which were only moderately severe. How the exercises were to be applied depended on the apparatus available. Massage, passive movements, resistance gymnastics which were gradually increased, lifting exercises, walking, later games and finally group exercises and group turning (apparatus) by command gave the best results and above all the patients' confidence was restored when they saw that their heart trouble did not grow worse under exercise methodically applied. It was always necessary to see that the patients did not lapse into idleness, and that if they were not fit for military service they were returned as soon as possible to some gainful occupation. And in the stage when strenuous exertion was not yet possible some easy occupation which would divert the attention was very beneficial. Light garden work, basket weaving, book-binding and such, in which the value of routine work was always to be emphasized and the patients assured that it was of individual worth for them, proved to be especially suitable.

So far as medication was concerned, if there was nothing organically wrong, if none of the indications discussed elsewhere were present, the peculiar remedies, especially those of the digitalis group, were entirely useless in cases of nervous heart disorder. Large and persistent doses of digitalis did not avail to reduce the frequency of the pulse in nervous tachycardia. The same was true of caffeine, camphor and similar drugs. In cases of extra systole strychnine was often useful, sometimes in combination with quinine, which latter in auricular fibrillation, more recently with quinidin, has often produced favorable therapeutic effects. However, the ordering of recognized heart remedies is to be avoided because it tends to confirm the patient in the belief that he has heart trouble and this is undesirable from every point of view.

Sedatives and narcotics are indicated during the stage of excitement,

but should be used as sparingly as possible. Very favorable effects have been ascribed to valerian preparations. I have seen no striking effect myself from their employment in these cases. Tonics are in order with run-down patients, but especially a nutritious diet.

It need not be emphasized that symptoms on the part of the other organs, reflexly conditioned, were encountered and had to be dealt with, especially dyspeptic symptoms and particularly were disorders due to the use of alcohol, tobacco, coffee and tea to be overcome. In fleshy people we strove to reduce the body weight, and in elderly patients especially this had a happy effect. Under-nourished and anemic individuals were treated according to the nature of the trouble. The favorable influence of liberal feeding in nervous people was already well known and could be demonstrated in many poorly nourished soldiers.

A rich means of physical therapy existed in the hospitals which were taken over at health resorts and in pre-existing peace-time sanatoria and the methods applied there succeeded, especially after the war was over and the cares and anxieties induced by the threatened return to the front had fallen away, in freeing most of the cardiac neurotics from their complaints, so that their number is extraordinarily reduced and there are only a few who need to be awarded compensation. Even this small remaining number is gradually melting away, and it is to be hoped that functional heart disorders will play a small part in future awards to disabled veterans.

"ACUTE CATARRHAL JAUNDICE"

REPORT OF 218 CASES; REVIEW OF ONE HUNDRED CASES; METHOD OF EXAMINATION; GASTRODUODENAL INTUBATION; RELATION TO SYPHILIS; FINDINGS; TREATMENT; CONCLUSIONS. PARTS I AND II.

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(With two illustrations)

JAUNDICE is a symptom and not a disease. It is associated with many different conditions, which fact offers the opportunity for various classifications. It may be acquired or congenital. It may be obstructive or not obstructive, as shown by the presence or absence of bile in an appreciable amount in the stools. It may be acute or chronic. Finally, it may be classified etiologically. In the present study of jaundice the following classification is used:

A. Acquired.
   1. Obstructive, partial or complete.
      (1) Non-inflammatory.
      (2) Inflammatory.
   2. Intoxication of known origin.
      (1) Bacterial.
      (2) Protozoal.
         a. Spirochaetal.
         b. Plasmodial.
   3. Intoxication of unknown origin.
      (1) Acute yellow atrophy.
      (2) Epidemic jaundice.
      (3) Rocky Mountain spotted fever.
   4. Chemical.
      (1) Without gross blood changes.
      (2) With gross blood changes.

B. Congenital.
   1. Icterus of the new born.
   2. Hemolytic jaundice.

Examples of the above-mentioned forms of jaundice are as follows:

Acquired, Obstructive.—(1) Non-inflammatory: Stoppage of the common bile duct from within by stone or from without by pressure, new growth, especially carcinoma; (2) Inflammatory, as seen in "Acute catarrhal jaundice."

Intoxications of known origin.—(1) Bacterial, example, sepsis. (2) Protozoal; example: (*a*) syphilis, yellow fever, "infectious jaundice"; (*b*) Plasmodial; malaria.

Intoxications of unknown origin.—Acute yellow atrophy, epidemic jaundice, Rocky Mountain spotted fever.

Chemical.—(1) Without gross blood changes as seen following "T. N. T." powder, phosphorus, arsenic, chloroform, aeroplane paint poisoning. (2) With gross blood changes, following picric acid, snake bite venom, blood transfusions.

Congenital forms require no further description.

Although other forms of jaundice have been encountered during this investigation, this report will be confined to acute catarrhal jaundice, which is classified here as obstructive and inflammatory. It is a form of acquired jaundice. A case of acute yellow atrophy of the liver is included for purposes of comparison. As the findings were so nearly similar to the others (except in degree), this case of acute yellow atrophy of the liver is included in the figures.

Jaundice has been constantly present among the American troops on the Rhine for the last two years. It has been the leading or secondary symptom in 218 admissions to hospital. From June, 1920, to June, 1921, there were 99 cases. From August, 1921, to April, 1922, there were 119 cases. The earlier set of cases was treated in the usual manner as outlined in textbooks, the treatment being directed towards the leading complaint and any associated. These cases were not intensively studied and will be included here only casually. During the second period all jaundiced patients were admitted to a special ward where intensive study was carried out.

THE FIRST PERIOD

During this period patients were admitted to wards depending upon the leading complaint, and the clinical records show no special procedure directed towards the jaundice. The dates of onset and cure are missing in many records, therefore the days lost cannot be accurately determined. The average number of days in hospital for those 99 cases was 7.9. Of those patients, 22 were syphilitic, with an average of twenty-two days in hospital, as compared with 77 non-syphilitic cases with an average of about four days in hospital. The seasonal distribution was as follows:

TABLE I

1920

Month	*1st week*	*2nd week*	*3rd week*	*4th week*	*Total*
July	7	3	2	0	12
August	0	2	4	4	10
September	1	0	0	0	1
October	20	3	3	1	9
November	1	3	0	4	8
December	0	2	0	0	2
Total	11	10	9	9	42
1921					
January	0	0	0	1	1
February	5	9	3	2	19
March	3	5	4	1	13
April	2	1	1	2	6
May	4	2	1	5	12
June	4	1	1	0	6
Total	18	18	10	11	57
Grand total					99

The 22 cases of syphilis were represented in the following stages: primary 8, secondary 11, tertiary 2, unknown 1. No particular military unit was especially involved. Jaundice was sporadic over the entire command and had about the same distribution as is shown in Table 6, which shows the distribution for the second period. The command was stationed in about ten cities and villages along the Rhine. The strength was between 14,000 and 14,600 men. On the clinical records it was only occasionally seen that a temperature of above 98.6 was present, and this could usually be accounted for by some associated condition.

THE SECOND PERIOD

A definite plan was outlined in July, 1921, for the study of jaundice. This study continued until May, 1922, when the American troops were ordered to leave the Rhine. The report of this study will be made under two headings, "The Method of Examination" and "The Findings, Treatment and Conclusions." The latter will be found in a subsequent report.

Method of Examination.—Upon admission to hospital the case was entered in the "Nurse's Chart Book for Jaundice" which contains the following date: Reference number, name, organization, date of admission, dates of calomel and magnesium sulphate, dates when the urine and stools were negative or positive for bile, Wassermann test, hemoclastic crisis, results of blood counts, diets, hospital file number, dates of abnormal temperature, special medication, syphilis (its stage and courses of treatment), date of discharge from hospital.

Patients were weighed on admission and weekly thereafter. Specimens of feces and urine were collected separately and examined daily for bile. An aqueous solution of bichloride of mercury (saturated) is used for the examination of the stools. The intensity of the reddish color seems to be a satisfactory test for bile. It can be quantitatively recorded in the following manner, depending upon the degree of redness:

0(zero). +(plus). ++(double plus). +++(three plus).

The examination proceeded by days in the following manner:

First day: Physical examination, hemoclastic crisis liver functional test, Wassermann, blood counts, blood culture, collection of specimens of feces and urine.

Second day: Gastroduodenal intubation with the phenoltetrachlorphthalein liver functional test, gall bladder drainage, fluoroscopy and Roentgenograms with the tube in place where indicated, local duodenal treatment in some cases.

Third day: Gall bladder drainage.

Fourth day: Gall bladder drainage.

Tenth day: Gastroduodenal intubation with or without phenoltetrachlorphthalein testing.

Although this was the plan of examination, all cases were not subjected to the full procedure. Some were so mild that it was not necessary to retain them in hospital for ten days. Others showed normal findings with the intubation, and therefore fluoroscopy was not necessary. Liver functional testing was not commenced in the beginning of this investigation, but became a routine later on. Cases showing evidence of ulceration, obstruction to the passage of the tube or doubtful findings offered by intubation were given a complete gastrointestinal radiographic series.

Each step in the method of examination will now be described in sufficient detail to make it comprehensible.

Physical examination.—The usual physical examination was made and recorded. In addition to this, the following questionnaire and special physical examination blank was prepared.

Some of these questions require description. For example, on page "2" the words "Appearance of eyes B (scale O–V)" and the same for the skin; also "Tongue T (scale C–V)": This is a degree scale arbitrarily adopted. The letter "B" indicates bile and a graduated scale of "O" to "V" (5 Roman) indicates the degree of jaundice. Thus "O" indicates no bile staining of the conjunctivae or skin, while "V" indicates the most bile stained condition that one can imagine. The following scale indicates degrees between these limits: +1, 1+, 2, 2+,

3, 3+, 4, 4+. The same scale is applied to the jaundiced condition of the skin. All cases were classified by degree of bile staining of the conjunctivae as follows: Mild, if less than "1" on the above scale; moderately severe," 1 to 2," inclusive; severe, "2 plus to 5." The conjunctiva was selected as the basis of classification rather than the skin, because the staining seems to appear there first, remain visible longer and is more easily read. This is especially true for persons with a dark skin. The staining appears first in the culdesac and spreads towards the limbus, remaining more intense in the former position and clearing up in the inverse order from its appearance. In mild cases there was a clear zone around the limbus that was not bile stained. In severe cases no difference in intensity could be made out. In severe cases the skin was usually dry and often difficult to write upon with a skin pencil. In two severe cases (4 plus) bile was excreted through the skin to the extent that the sponge and bath water were distinctly colored yellow. Scaling usually followed in the more severe cases. This was a fine furfuracous desquamation over the entire body.

Page "1"

QUESTIONNAIRE

HAVE YOU SUFFERED FROM —

Heart burn? Ball in the stomach?
Distress after eating?
Vomiting? Sour stomach?
Chills? Fever? Sweats?
Pain anywhere, sharp?
Dull pain anywhere?
Loss of weight? How much?
Constipation? Diarrhea?
Dizziness? Loss of appetite?
Weakness? Itching skin?
Sleeplessness? Belching gas?
How do you feel now?
How much of a drinker have you been in the last two years (heavy, moderate, light, none at all)?
Have you taken "606" or any other treatment for syphilis in your life?
Have you taken chloroform, worked with "T.N.T." powder, arsenic, phosphorus, aeroplane "dope" or paints lately?
Have you had syphilis? Stage?
Treatment ....
Have you had malaria?
How long have you been jaundiced?
Have you had it before?
Have you suffered from bad colds, sore throat, "flu" in the last few months?
Describe
Have you been exposed to the cold and wet lately so you have become chilled?
Remarks

Page "2"

PHYSICAL EXAMINATION

SPECIAL HISTORY

Appearance of stools Bile
of urine Bile
Size of liver cm.
Tenderness of liver
Outline of spleen
Contour of liver (smooth, rough)
Blood: Wassermann
R.B.C. W.B.C.
Differential
Hemoglobin . % Coag, time.
Special culture
Appearance of eyes B (scale O to V)
Appearance of skin B (scale O to V)
Tongue T (scale C to V). Breath
Temperature Pulse Respirations.
Abdominal distension.
Tenderness Local Swelling
Odema of feet, eyes
Heart (pathology present?)
Age yrs. General appearance in development and nourishment
Mental state (clear, foggy)
Leucin, tyrosin, albumin, casts
Is neurological exam. indicated?
Is there evidence of gall stones?
Malignancy? Acute yellow atrophy?
Sepsis? Syphilis? Malaria?
Gastritis? Epidemic jaundice? Chemical poisons? Blood transfusions?
Duration of jauncice

The tongue was not used as a basis of classification but was an excellent indication of progress. The degree of coating ranged from

"C" (clean) to "V" (5 Roman), the most coated tongue that one can imagine. The intermediate degrees were the same as used for the conjunctiva and skin.

The size of the liver was determined by percussion and palpation. The upper area of percussion dullness in the right nipple line was determined and marked by a skin pencil. The lower limit of the right lobe of the liver was determined by palpation in the same line. The lower costal margin was then marked during quiet respiration. These distances were then measured and a common fraction formed—i.e., "12.5/1." The numerator is the total distance from the upper limit of percussion dullness to the lower palpable limit of the liver. The denominator is the distance from the costal margin to the lower edge of the liver. This constitutes what is spoken of in this paper as "The Liver Index."

Mental state was recorded only as a subjective symptom, the words "clear" and "foggy" being used, depending upon the statements of the patient. Some of the questions require very careful explanation to the patient, otherwise incorrect answers would often have been given. Of these, "heart burn, ball in the stomach, distress after eating, sour stomach, chills, fever, sweats, loss of weight, gas, sleeplessness; How much of a drinker have you been? and exposure to chemicals" are the most important. It is very probable that many of the answers given regarding the use of alcohol are not entirely correct.

Patients were routinely examined every third day and the following progress noted:

Date: Liver index: Tongue (degree): Eyes: Skin: Blood pressure: Remarks: Under "Remarks" were noted the following: Appetite, stools (general appearance and amount of bile), urine (same as bile), improvement in general, and any special remarks of importance.

Method of Laboratory Examination.—(1) Hemoclastic crisis. This is the Widol liver functional test as described by Widol of Germany. The technique described by Römer is as follows: Whole milk, 300 to 500 c.c., is given on the fasting stomach and observations are made at twenty minute intervals to note the change in the leucocyte count. A leucopenia indicated a lowered liver function. The degree of leucopenia is not supposed to indicate the degree of lowered liver function; it is qualitative and not quantitative. A leucocytosis or no change in the white cell count is of no value in indicating disturbed liver function. The test was carried out in the following manner during this investigation. The patient has his usual diet for the evening meal before the test. Nothing is taken by mouth after midnight, and the patient remains in bed until the examination is completed. At 7 a. m. leucocyte

and differential blood counts are made. The patient is then given two glasses of fresh milk (about 250 c.c.). At exactly twenty minutes after taking the milk, count No. "2" is made. Count No. "3" is made at 40 minutes and No. "4" at 60 minutes, thus one control and three tests are made. The findings are then graphically charted and the curve read.

2. The Wassermann test was made on all patients and repeated as often as necessary. Blood and bile cultures, as well as dark field examinations, were made in thirteen cases. The cultures were made on one or more of the following media; anaerobically on human serum broth, acetic agar, beef acetic agar, human serum agar, plain agar, and aerobically on plain bouillon, acetic broth, beef agar, and plain human serum.

3. *Gastro-duodenal intubation.*—The Rehfus, Pflaski, and *duodenal improvised,* tubes were used with about equal results. Some patients were kept on the right side and upon an operating table during the entire examination, while others were ambulatory—that is, they remained on their beds during the intervals but walked to the examining rooms where stomach and duodenal specimens were removed at regular times. The tube was passed on the fasting stomach. The entire stomach contents were then removed with the patient in three positions, normally sitting, on the right side, and then on the left side. The stomach was washed with 120 c.c. water and the amount recovered measured. The patient was then given a glass of water, told to swallow the tube slowly to the second mark and remain on the right side. In addition the right hip was at times raised higher than the shoulders by placing two pillows under the right side of the pelvis. The above process was carried out by the nurse commencing at 7.30 a. m. At 8.30 a. m. examinations were made by the doctor to determine whether or not the tube was in the duodenum. A specimen was removed. The patient was then given a cup of bouillon cube broth. The form of bouillon cube used is one entirely soluble in hot water and does not give a positive occult blood test with benzidin. One half-hour after taking the broth another specimen is removed (fractional duodenal contents No. "1"). This is repeated at half-hour intervals until four fractional contents have been obtained. All specimen bottles bear the patient's name and name of the specimen. Adhesive plaster 1 inch wide is very satisfactory for this purpose, and typewriter is better then pencil for the actual writing. Large mouth 4-ounce bottles are the most convenient size for specimen bottles. Each specimen should be carefully examined *as it is obtained* and while passing through the glass tube window.

The following points were noted in the gross specimens; amount, color, transparency, evidence of gross blood (even in minute amounts) evidence of hemolyzed blood, mucus, pus, muco-pus. After the specimens had been allowed to stand, it was noted whether blood, mucus, pus or any other solid matter rose to the top or settled to the bottom. Aerated specimens tend to rise to the top while those obtained from the stomach and duodenum tend to settle to the bottom. Gross blood was noted at once; if allowed to stand the macroscopic blood sometimes hemolyzes and disappears from sight. The change in color was also noted with the time since the specimen was obtained. The important change in color is from varying shades of yellow to various shades of green. Yellow bile (bilirubin) will turn green (biliverdin) in the presence of free hydrochloric acid. This change to green does not take place in a specimen unless both bile and free HCl are present. The degree of intensity of the green is a rough quantitative test of the amount of free HCl. The amount of bile can be roughly estimated by the deepness of the yellow.

The above-mentioned seven specimens, fasting stomach contents, stomach washings, fasting duodenal contents, and the four fractional duodenal contents, were arranged on the examining desk for further examination. With the exception of the stomach washings, all were examined microscopically and chemically. As soon as No. 4 fractional duodenal contents was obtained, 50 miligrams of phenoltetrachlorphthalein were injected intravenously into one of the superficial veins of the elbow by means of a 1 c.c. tuberculin syringe. The patient was given a glass of water before injecting the dye, and another immediately afterwards. This is done to prevent dry duodenal taps. Four specimens of bile were then obtained through the tube, the first at 12 to 15 minutes after injecting the dye, the second at 15 to 20 minutes, the third in 20 to 25 minutes, and the fourth in 25 to 30 minutes. Specimen No. 4, fractional duodenal contents acts as the control. Occasionally it is necessary to give a third glass of water to keep up the duodenal flow.

Biliary drainage by gravity is then accomplished. About 40 c.c. of a 25 per cent solution of magnesium sulphate in water is injected through the duodenal tube, as has often been described in current literature. The tube is then connected with an Erlenmeyer flask of about 500 c.c. capacity. This flask has a rubber stopper perforated by two glass tubes one of which is connected with the duodenal tube while the other allows the air to escape. Sufficient suction is afforded by having the patient on the table or bed and the flask on the floor. If the bile does not flow readily, the magnesium sulphate injection is repeated. It may be repeated several times. This specimen, too, is

studied as obtained and along the same general lines as above mentioned. In addition, search is made for evidence of calculi.

Where doubt exists as to the location of the tip of the duodenal tube the patient is fluoroscoped with the tube in place, great care being taken to see that the tube marker at the tooth margin does not move. The patient is now given a small test meal—about 30 grams of

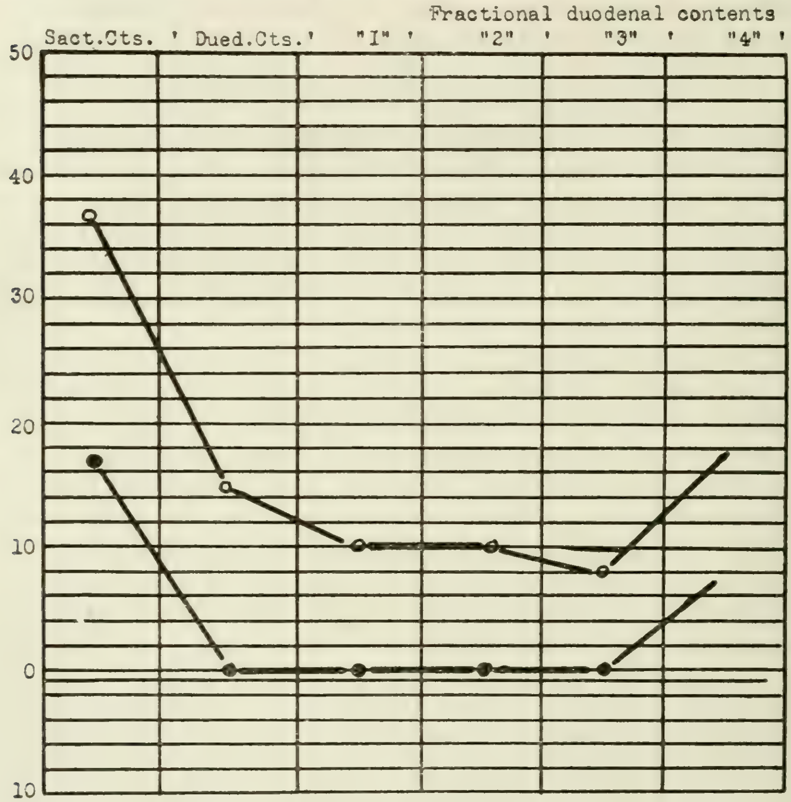

Fig. 2.—Normal gastro duodenal curve.

barium, a teaspoonful of acacia mixed with fresh milk and water then thoroughly agitated. The patient is stripped to the waist. He takes the tube in the right hand and stands before the fluoroscope. The course of the tube is now followed from the neck to the metal tip. The meal is then swallowed, whereupon the outline of the stomach, peristalsis, emptying time of the stomach, duodenal cap, and the movements of the meal along the intestines are studied. If there is suspicion as to oesophageal pathology, this, too, is studied as the meal descends into the stomach. The tube is now withdrawn. There has been no difficulty

in withdrawing the tube and, as a rule, it has been more agreeable to the patient to remove it himself. The duodenal tug has been of no value in locating the pylorus during this investigation. Slight constriction is usually noted at the cardia and opposite the bifurcation of the bronchi. The tube practically always stops at the cricoid constriction when a slight pull and gagging by the patient allows the tip to pass. The tube occasionally coils in the stomach and on one occasion was tied in a complete knot. This can usually be prevented by having the patient swallow the tube slowly after the tip has once reached the stomach. It is better to have the patient take about ten minutes to swallow the tube from the first to the second mark. Where there is much mucus or pus the tip at times becomes stopped. This can be detected by the fact that, while air or fluids may be forced through the tube with some resistance, little or no fluid can be recovered. When definite difficulties develop, the tube is withdrawn. When the tip is *in* the pylorus, obstruction similar to that described is also present, but this passes off in a few minutes.

Where angulations were noted with the fluoroscope or adhesions suspected, X-ray plates were made with the tube in place according to the method of Pflaski. Such plates afforded no information of value during this series. The improvised duodenal tubes were as satisfactory as the others except that it was impossible to obtain rubber tubing that could be seen with the X-ray. This objection was overcome by injecting the tube in place with barium. The tube then became visible. If a small excess of barium was used over the filling capacity of the tube, this excess formed a picture at the tip. When the tip was in the stomach, the picture was different from that formed when the tip was in the duodenum. In the former case a dark mass is formed around the tip, more or less flat in outline, and tends to remain quiet while the tip is practically lost sight of. When the tip is in the duodenum, the shadow formed by the barium is longer in the direction of the intestine, moves forward in the direction of the gut and usually does not completely obscure the outline of the tip. Palpation, too, must be used in locating the position of the tip. There were times when the tip appeared to be in the stomach, but when the stomach was pushed upward the tip did not move and was found in the intestine back of the stomach. The tip should not be allowed to go beyond the pylorus more than 3 inches unless visualization of the upper intestinal tract is desired. If the tip passes into the jejunum, one is usually unable to obtain specimens and is apt to be misled by this.

Chemical examination was made of all specimens. The following arrangement on the laboratory bench is convenient:

	Stom. cont.	Stom. wash.	Duod. cont.	Frac.	duod.	cnts.	
1st row: Spec. bottles.......	1	1	1	1	2	3	4
2nd row: Beakers for exam...	1	1	1	1	1	1	1
3rd row: Test tubes for occult blood...........	1	1	1	1	1	1	1
4th row: For dye test.......		Control, 12–15	15–20	20–25	25–30 minute		
5th row: Test tubes for dye testing..........	1	1	1	1	1		

Pour about one ounce of distilled water in each beaker of row two. Put about 10 c.c. of a 40 per cent solution of sodium hydroxide or potassium hydroxide in each of the test tubes of row five. Put exactly 5 c.c. of the contents of row one into the beaker immediately back of the specimen; while the pipette is being used for a certain specimen of row one, place a few drops of the same specimen in the test tube of row three, after about 10 c.c. of a freshly prepared solution of benzidin-glacial acetic acid-hydrogen peroxide has been put into the tube.

Examinations.—If occult blood is present (row three), the fluid turns green. This is accelerated by agitation. The depth of the green is a rough quantitative test for the amount of occult blood. The test must be read immediately as the green color does not remain very long. The phenoltetrachlorphthalein tests are made next. Place a few drops of each specimen in row four into the test tubes of row five containing the alkali; then shake the tube. If the dye is present, a purple color appears immediately and will be distinct enough to be read without doubt. In this manner the excretion time of the dye through the liver is determined. The normal limit has been placed at twenty minutes. If no dye has been excreted by the 15 to 20 minutes specimen, and the test has been properly performed, lowered liver function is indicated. The final test is for the acidity, free and total. Add a few drops of a standard dimethylamine solution to the beakers of row two, stir and titrate against a tenth normal sodium hydroxide solution. When free HCl is present, the color becomes a rose red on adding the dimethylamine; if there is no free HCl the color is a muddy yellow. If HCl is present, titrate with N/10 NaOH until the rose color disappears. The amount of N/10 NaOH used is read and multiplied by 20. This gives the parts of free HCl per 100 c.c. of contents examined. Now a few drops of phenolphthalein solution are added to the same specimen and the titration continued until the solution becomes red. Read the *total* amount of N/10 NaOH used and multiply by 20. This gives the *total* acidity per 100 c.c. of contents.

Note the change in color of each specimen in row one and the time that has been required for this change. Complete the report sheet by

entering the free HCl, total acids, presence or absence of occult blood, the dye specimen that was positive for the dye, fluoroscopic findings and conclusions drawn from the complete examination. In addition to noting the free and total acidity on the report sheet, make a graphic chart using these figures for the purpose. The curves often furnished information of value in diagnosis as will be explained in the second paper of this report. The following is a sample report sheet of gastroduodenal intubation in a case showing no pathology:

No, 154

Tube No. 9	Smith, John	Oct. 9, 1921
A. P. A.	Private, Co. M. Infantry	

7.30 A. M. Usual procedure; no difficulty; fasting stomach contents removed in three positions, 30 c.c.: M (mucus) 2, while, cloudy; B (blood) 0; P (pus) 0; Food, none; T (turning) 0 in 3 hours; F. A. (free HCl) 17; T. A. (total acidity) 37; Ocb. (occult blood) 0.

Microscope: blood cells, neg.; pus cells, neg.; epithelium few squamous; bacteria few.

Stomach washings: 120 c.c. used, 120 c.c. recovered; white, clear; B-0; P0; M-* (plus).

8.30 A. M. Tube in duodenum; 15 c.c. clear, light amber, easily obtained; B-0; P-0; M-* (T-0-3 hours) F. A.-0; T. A.-15; Ocb.-0.

9 A. M. Cup cube broth.

9.30 A. M. 15 c.c., clear amber, B-0; P-0; M-*.
(T-0 in 2 hours). F. A.-0; T. A.-10; Ocb.-0.

10 A. M. 20 c.c., clear, amber, easily obtained, B-0; P-0; M-*.
(T-0 in 2 hours). F. A.-0; T. A.-10; Ocb.-0.

10.30 A. M. 10 c.c., clear, amber, B-0; P-0; M-*.
(T-0 in 2 hours). F. A.-0; T. A.-8.

11 A. M. 20 c.c., cloudy, amber, B-0; P-0; M-*.
(T-Light green in 2 hours.) F. A.-8; T. A.-18; Ocb.-0.

11.15 A. M. 50 mil. grms., phenoltetrachlorphthalein intravenously.
Control-0
12-15-m- -**
15-20-m-***
20-25-m-***
25-30-m-***

11.45 A. M. 40 c.c. of a 25 per cent solution $MgSO_4$ injected, connected with gravity flask. $MgSO_4$ repeated in 5 minutes. Total drainage 135 c.c. mixed biles, some stomach contents, no gravel, B-0- (gross and occult) P-0; M-* (T-dark green 1 hour).

Fluoroscope: Shows tip of the tube in the first portion of the duodenum; stomach outline normal, emptying time normal, duodenal cap appears normal. No pathology seen.

Conclusions:

No obstruction at the cardia.
No obstruction at the pylorus.
No gastritis, no duodenitis.
No obstruction to flow of bile or evidence of disease along the biliary tract.
Liver functional test normal.

Sample report sheets of cases showing pathology will be given in the second paper on this subject.

The method of obtaining stomach and duodenal contents is important. Several means were tried. The gravity method was abandoned as being too slow and uncertain. Suction by means of a glass syringe was tried and discontinued as there was no reliable control over the amount of vacuum with the syringe and it was thought on several occasions that trauma had been inflicted by this means. The apparatus described below was constructed for this purpose and has been used more than 300 times with satisfactory results. The mercury manometer will not allow more than 6 inches of mercury vacuum, and as little vacuum can be used as desired. The writer does not believe it possible to cause trauma by this apparatus. (Fig. 3.)

Description of apparatus: A, stand to hold apparatus. *C*, 4-ounce bottle with perforated rubber cork having 3 holes—1 to duodenal tube, 1 to vacuum pump, 1 to safety bottle *E*. *D*, metal ring to secure *C* to *A*. *E*, 4-ounce bottle with perforated rubber cork having 2 holes, 1 to bottle *C*, 1 to mercury manometer *F*. *F*, mercury manometer connected with *E*. *G*, metal ring to fasten *E* to *A*. *H*, metal ring to hold *F* to *A* and to provide a holder for the connection between *C* and the stomach or duodenal tube when not in use. This connection is the glass tube *I*; by placing the end slightly into the duodenal tube, completely or partially occluding the opening, the desired amount of vacuum can be obtained up to the maximum of the apparatus. It can also be quickly withdrawn if desired, thus breaking the vacuum. *J*, vacuum pump attached to any ordinary water faucet by a friction rubber gasket without threads. *K*, rubber tubing connecting pump *J* to specimen bottle *C*. Collecting bottle *E* serves the purpose of collecting the mercury in case it should overflow from the manometer. Rings *D* and *G* hold the bottles in place loosely without being attached directly to them, thus allowing the bottle to be emptied without being disconnected. Tubing *K* can be as long as ordinarily desired, e.g., 50 feet; by this means the apparatus can be taken to the patient's bed if the patient cannot come to the examining room.

For purposes of comparison, a casual survey was made of the local civilian population for jaundice by observing persons seen on the streets, in the stores and in public places. Visits to local hospitals were made for the same purpose. Local physicians (German) were questioned regarding the amount of jaundice in the civil population. At the same time the Chief Surgeon of the American Forces caused an inspection to be made of all troops with a view to the detection of cases showing jaundice but not on sick report. The findings, results of treatments, the relation of the above conditions to syphilis will be presented in a subsequent report.

PART II

The subject of Part I was "The Method of Examination," and an attempt was made to describe the plan of examination in such detail as to make it comprehensible to the reader without burdening him with unnecessary detail. Part II is a continuation of the above and is devoted to the findings, treatment, and conclusions drawn from the study of 218 cases of acute catarrhal icterus in the American troops on the Rhine and advanced study in the clinics and at the University in Vienna, Austria.

Jaundice is merely a symptom as outlined in the previous report. It may be associated with many pathological processes, some of which are known, while others are unknown. It may not only be the result of infection, intoxication, or hemolysis but may be purely the result of a mechanical obstruction to the flow of bile through the bile ducts. In addition to this, there are cases where no pathological condition can be found at post-mortem to account for the jaundice. The so-called "Acute Catarrhal Jaundice" belongs to this latter class.

Following the experience of English pathologists, Virchow attributed the cause of catarrhal jaundice to a thickening and swelling of the mucous membrane of the common bile duct, resulting in a mechanical obstruction to the flow of bile. This is not substantiated by post-mortem findings in catarrhal jaundice. However, edema of the larynx is not found at post-mortem examination, and still no one would deny its existence in life. Eppinger (1) had occasion to examine cases of acute catarrhal jaundice post-mortem at four different times during the war. He was unable to support the Virchow theory of this form of jaundice and found neither macroscopic nor microscopic pathological change in the bile ducts. On the other hand, Eppinger did find changes in the hepatic parenchyma.

During the period covered by this report, there were, in addition to the 218 cases of catarrhal jaundice, three cases of acute yellow atrophy of the liver admitted to this hospital. They were typical cases with symptoms and signs as found in all standard textbook descriptions. The diagnosis was confirmed at autopsy. On admission to hospital these cases were diagnosed as acute catarrhal jaundice. They presented the same clinical picture with symptoms referable to the gastrointestinal tract (nausea, vomiting, anorexia, coated tongue, foul breath, etc.) moderate degree of jaundice, mental "fogginess," urobilin in the urine, enlargement of the liver both upward and downward, urine negative for albumin, casts and leucin and tyrosis crystals. It was only by the intensity in the development of the symptoms and signs, rapid diminution in the size of the liver, death, and post-mortem findings that we were able to make the differential diagnosis. Of the

three cases, one showed the leucin and tyrosis crystals in the urine before death. In other words, the clinical differences between these cases of catarrhal jaundice and those of acute yellow atrophy of the liver were the comparative mildness of symptoms and signs, absence of leucin and tyrosin crystals in the urine, and recovery of all cases of catarrhal jaundice (except one), and the intensity of the same signs and symptoms, occasional presence of leucin and tyrosin crystals, enlargement and then reduction in the size of the liver not to normal but to about one-half the normal size, and death in the case of acute yellow atrophy. These latter three cases were all cases of syphilis undergoing treatment with silbersalvarsan (silver salvarsan) and mercury. On the other hand, 35 per cent of the cases of catarrhal jaundice were cases of syphilis, as may be seen below, and undergoing the same treatment. The following table shows a comparison between a case of acute yellow atrophy of the liver, the cases of acute catarrhal jaundice undergoing syphilitic treatment, and the cases of catarrhal jaundice that had neither syphilitic history nor syphilitic findings:

TABLE III

	Acute yellow atrophy	*Jaundice with syphilis*	*Jaundice without syphilis*
No. of cases	1	35	65
Complaints referable to the gastro-intestinal tract	yes	24	55
Pain in abdomen	no	19	24
Vomiting	yes	18	33
Dizziness	no	14	32
Weakness	yes	22	39
Loss of appetite	yes	20	43
Itching of the skin	no	10	26
Tenderness over liver	no	8	8
Pus in upper resp. tract	no	9	20
Bradycardia (beginning)	no	0	3
Appearance of stools:			
Light	no	12	11
Dark	yes	30	49
Blood-leucocytosis	no	1	4
Leucopenia	no	8	23
Eosinophilia	no	1	1
Red cells over 5,000,000	no	12	24
Red cells under 5,000,000	yes	3	2
Stomach contents:			
Anhydria	yes	4	16
Hyperacidity	no	1	3

The number of cases of "jaundice with syphilis" is approximately one-half the number of cases of "jaundice without syphilis," therefore the comparison is clearer if one multiplies the former by two.

Syphilis was common on the Rhine and was present in approximately one-third of the patients admitted to the hospital for jaundice; however, the percentage was about the same for other admissions to the general medical service.

There were 119 cases of catarrhal jaundice studied in this series. Nineteen are not included on account of errors in the records. The percentages would be about the same if these cases were included. Syphilis and its treatment by silbersalvarsan with or without mercury was especially studied with the jaundiced syphilitic patients. The most striking differences between the two were that there were more anemia and symptoms referable to the liver in those patients with both jaundice and syphilis. However, one could not differentiate the two clinically. It was only by means of the Wassermann reaction and other specific evidences of syphilis that the diagnosis of syphilis was made. Only one case of jaundice received antisyphilitic treatment while jaundiced. We were afraid to give syphilitic treatment to a patient with a probably diseased liver. The only point of special note in this case was that the number of days of jaundice was greater. However, this case was transferred to the venereal wards and did not receive the dietetic treatment or medication that the remaining syphilitic jaundiced patients received who were treated on the medical service.

As described in Part I of this paper, the cases were divided into three groups, depending upon the degree of staining of the conjunctivae, i. e.; (*A*) Mild (if less than "1" on the scale described in the previous paper); (*B*) moderately severe (from "1" to "2" inclusive); and (*C*) severe (staining over "2"). Depending upon the results of the gastro-duodenal examinations and X-ray studies, this group of one hundred cases was divided into three primary groups: (1) cases of catarrhal jaundice that showed no evidence of inflammation of the stomach or intestines; (2) cases showing gastritis, duodenitis, or both but without evidence of ulceration; (3) included those cases showing ulceration of the stomach or duodenum or both.

Therefore each primary group had three subgroups—*A*, *B*, *C*—based upon the intensity of the jaundice, that is, nine subgroups in all. For the purpose of studying the relationship of syphilis to this jaundice, each of the subgroups was further subdivided into four sub-subgroups as follows: "*R*," syphilis, but the patient received no treatment; "*I*," patient under treatment for syphilis but not beyond the second course of treatment; "*S*," patient under syphilitic treatment and beyond the second course; "*P*," Wassermann reaction negative, no history of syphilis, and nothing in the physical examination to indicate syphilis. Reference to Table IV will show the distribution by groups and subgroups of these cases, also the total number of days of jaundice (based upon the date of onset to date of discharge from hospital) and the days of jaundice in hospital.

In groups "1" and "2" the total days of jaundice and also the days lost in hospital are slightly greater in the syphilitic cases than in the

TABLE IV

Primary group	Subgroup	Sub-sub-group	No. cases	Total	Days—lost: In hosp.	Days—lost: Syph.	Days—lost: Non S.	Days—lost: Average
1. 10 cases.	A.—S. 0	R	0	0	0	0	0	0
S†, 2(20%)	No S, 5	I	0	0	0	0	0	0
		S	0	0	0	0	0	0
		P	5	15.2	8			
No S, 8(80%)	B—S, 0	R	0	0	0	0	0	0
		I	0	0	0	0	0	0
	No S, 3	S	2	19.5	12.0	12.0*	8.9*	9.9*
		P	3	18.3	9.7			
	C—S and No S, 0	R-I-S-P	0					
2. 69 cases.	A—S, 5	R	0	0	0			
S, 24(34.8%)	No S, 6	I	2	56.0	39.5			
		S	3	35.3	18.3			
		P	4	13.5	8.3			
	B—S, 15	R	1	10.0	9.0			
	No S, 32	I	4	21.2	13.8			
		S	10	26.1	14.6	15.1	14.2	15.5
		P	32	24.0	15.1			
No S, 45(65.2%)	C—S, 4	R	0	0	0			
	No S, 7	I	0	0	0			
		S	4	38.0	28.5			
		P	7	38.9	27.9			
3. 21 cases.	A—S, 2	R-I	0	0	0			
S, 9(42.9%)	No S, 2	S	2	50.0	16.0			
		P	2	42.0	31.5			
	B—S, 5	R-I	0	0	0			
	No S, 7	I	2	21.5	12.5			
		S	3	29.0	22.0	13.2	19.8	16.9
No S, 12(57.1%)		P	7	29.3	19.6			
	C—S, 2	R-I	0	0	0			
	No S, 3	S	2	38.5	30.5			
		P	3	27.3	23.0			

* Average days in hospital. † Syphilis. Total: Syphilis 35%, divided as follows: R, 1%; I, 8%; S, 26%. Nonsyphilitic, 65%.

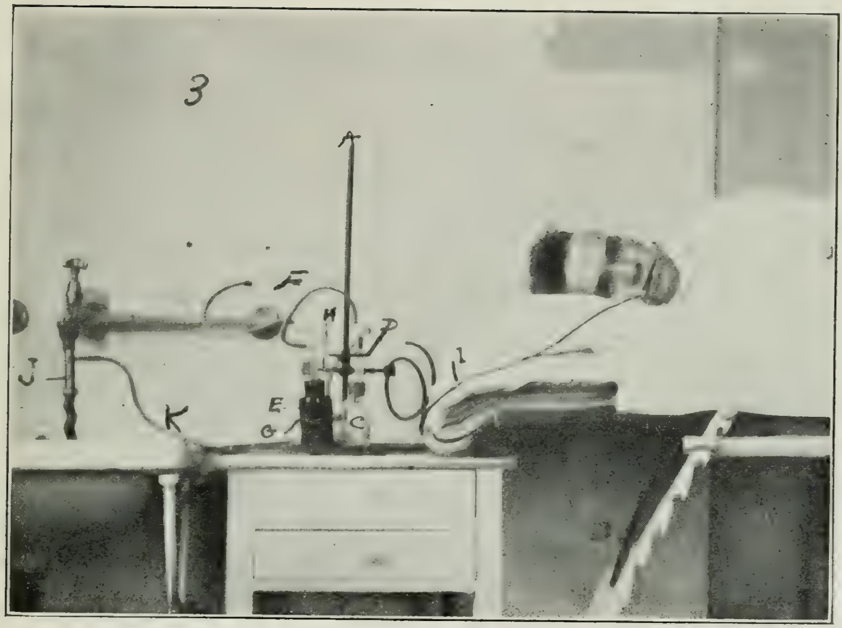

Fig. 3.

(Face page 406)

nonsyphilitic cases, but this condition is reversed in group "3." Most of the syphilitic cases (26 per cent) belong to the "*S*" subgroup; that is, those cases that had received the largest amount of treatment.

Table V shows some of the more important findings in the respective groups, "1," "2," "3," further subdivided into syphilitic and nonsyphilitic cases. A striking feature in this table is the similarity between the specific and the nonspecific cases.

TABLE V

	(1)		(2)		(3)	
	S.*	No S.*	S.	No S.	S.	No S.
Number of cases	2	8	24	45	9	12
Habits as to alcohol:						
Heavy	1	4	1	5	0	2
Moderate	0	1	8	15	4	6
Light	0	2	11	14	4	4
Denies	1	1	4	11	1	00
Stomach contents—show bile	0	3	6/13	12/21	2/18	4/16†
Average amount	?	?	48	45	57	36
Largest amount	42	90	120	120	90	100
Smallest amount	0	10	6	3	30	2
Average acidity (free)	32	30	25	16	28	19
Highest acidity	30	78	54	68	56	62
Duodenal tube pass	0	8	18/6	34/8	5/3	7/3
Biliary obstruction	2	2	10/14	15/29	2	2
Non-obstruction	0	6	14	29	8	10
Liver-enlargement upward	1	1	16	24	7	8
Downward	1	0	14	22	6	9
Upward and downward	1	0	10	20	5	8
Becoming smaller with treatment:						
Upward	1	1	8	12	3	7
Downward	1	1	6	14	5	9
Upward and downward	1	1	6	12	3	7
Index-on admission, average	12.5/2	12.6/0	12.1/2	12.8/1	14/1.8	13.6/22
on discharge from hospital	12/0.5	11.4/0	12.1/1.4	12.1/1	13.1/1.3	12.6/.7
Days of jaundice, average, total	19.5	12.0	22.1	24.9	24.1	27.4
in hospital	16.7	8.9	15.1	14.2	13.2	19.8
Improvement, gradual	1	1	17	22	6	8
Rapid	1	7	4	12	2	3

* Indicates syphilis and "No S." indicates no syphilis.

† Where double figures are shown as 4/16, the first is positive and the latter negative.

Alcoholic drinks of almost all kinds were available on the Rhine. It was thought that possibly these drinks were playing an important part in the etiology. It is difficult to obtain an accurate alcoholic history from the average man, therefore figures shown in above are subject to error. The degree of alcoholism was recorded as follows: heavy, moderate, light, denies—covering the clinical history for the last two years. Some persons will deny the taking of alcoholic drinks while others exaggerate it. There is a great difference in the meaning of

"heavy drinker" among different persons. Table V shows the alcoholic history of these cases.

Table I, Part I, shows the seasonal distribution of the first 99 cases of jaundice. Table VI shows the seasonal and organizational distribution of the remaining 119 cases.

TABLE VI

	1921						1922			
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
5th Infantry				1						
Co. A			1							
B				1	2		2			
D			2			1				
F		1	1						1	
H					1					
I	1		3	1			2			
K									1	
L				1						
Serv				1						
8th Infantry Hq				1						
Co. A					1					
B		3							2	
C							1			
D			1							
E						1	1			
F				4	1					
G				1	2					
H								1		
K		1							1	
How. Co					1					
Serv. Co				1						
M								1		
50th Infantry Hq				1		1				
Co. B		1								
C[2]		1								
F					1	1				
G	1			1	1					
K		1								
M				1						
Hd. 3d Bn				1						
Serv. Co				1						
6th Field Artillery Hq									1	
Co. D		1							1	
E									1	
F	1	1								
Station Hospital		2			1	2		3		
1st Engineers, Co. A		2						2		
B		1								
Prov. Mg. Bnn. Co. B			2							
C	1									
D		1								
2nd Sig. Co		1		1					1	
Prov. M. P. Co	1	2						1		
Ambulance Co. 56	1									
Q.M.C. (transportation)		1								
Post. Q.M.C		1		1			1	1	1	
Prov. Cav. Squadron—Cp. A				1						
B						1	2	1		
Hq							1			
Med. Det							2			
Air Serv. Det							2			
60th Ord. Det					1			1	1	
Hq. 1st Brig						1				
British Army and Civ					1			1	1	
Hq. Det. A. F. G					1			1		
Med. Det. 2nd Brig			1							
Total	6	21	11	20	14	8	14	13	12	119
Strength of the command	13,025	12,565	12,224	11,480	10,961	9,756	7,277	6,188		

It will be seen that the organization played no etiological part in the cause of this jaundice, and it is very probable also that the season played

no important part. It is true that there were more cases during some months than others. The various organizations had their own individual kitchens and prepared their food largely according to their own tastes. This would indicate that the organization food played no important etiological part. It is true that all organizations had some food in common that was issued from the common commissary; on the other hand, more than one-half of the organizations on the Rhine had no jaundice in their commands. Table VI is not of a typical food-borne epidemic.

From experience, it is believed that the sour wines (the Mosel and Rhein wines), as well as the strong alcoholic beverages like cognac, contributed considerably to the cause of gastritis admitted to hospital. Prof. Eppinger, Klinik Wenckebach, Vienna, believes that sausage as found on the market, packed in skins and called "wurst," contain a substance that, if taken with food, causes jaundice. This substance is related to the animal alkaloids. Since Prof. Eppinger made this statement all patients who have come under my observation with jaundice have been carefully questioned about eating this type of sausage, and it has been possible to obtain a positive history in every case. The soldiers obtain this sausage from sandwich wagons in the vicinity of the barracks or in the city. This might also explain why no jaundice has been seen among the officers and their families as this type of food would not generally be eaten. There is also no record of a case among the soldiers who were married and messing separately. It is believed that the "sausage theory" should be given more weight than the effects of sour wines.

In November, 1921, the Chief Surgeon, American Forces in Germany, caused a survey to be made of the entire command and the number of cases of jaundice reported. This report showed 71 cases not in hospital and distributed as follows (see Table VII):

TABLE VII

	Severe	*Moderate*	*Slight*
Air Service Det.	....	....	1
Motor Trans. Serv.	....	1	....
20th Serv. Co. S. C.	....	1	....
Station Hospital	....	....	1
G. M. Corps	....	....	2
Port of Antwerp	....	....	10
Prov. M. P. Company	....	....	1
Eighth Infantry	2	4	23
Prov. Cav. Squadron	....	1	....
2nd Bn., 6th F. A.	....	....	2
Prov. M. G. Bn.	....	....	1
Fifth Infantry	3	1	1
Fiftieth Infantry	....	1	15
	5	9	57
Total			71

The severe and moderately severe cases, 14 in all, as well as some of the

light cases, were later transferred to hospital and became a part of the 218 total cases here reported upon. Approximately 40 cases were not admitted to hospital. There was just the one survey of this kind. Therefore, one can readily see that there must have been at other times many cases of light jaundice in the command that never came on sick report.

Although the total strength of the command was between 13,000 and 14,000, there were no cases of jaundice among the officers or their families so far as known, and a survey of the former was made. There were approximately 1,000 officers, women and children. The women and children, generally speaking, were those of officers' families. Their living conditions as to housing, food, and exposure to weather, were different from those of the enlisted men. The amount of syphilis was far greater among the soldiers. This paper is concerned with jaundice as admitted to hospital.

At the same time that the survey was made of the command, a survey was made of the local hospitals in Coblenz, civilians were observed in public places, and conferences held with local German doctors relative to jaundice. It was impossible to formulate any figures as to the amount of jaundice among the civil population, but it certainly was not common.

The bile of seven typical cases was obtained by means of the duodenal sound and cultivated aerobically on plain bouillon, asitic broth, and anaerobically on human serum broth, asitic agar, beef asitic agar, human serum agar, and plain agar. The blood beef agar, and anaerobically on human serum broth, asitic agar, beef asitic agar, human serum agar, and plain agar. The fresh specimens and cultures were also examined with the dark field. All cultures and dark field examination were negative except in a few instances where contamination with extraneous organisms occurred.

In examining patients with catarrhal jaundice one is struck with the frequency of complaints referable to the stomach, i. e., nausea, vomiting, headache, anorexia, coated tongue, etc. (see Table VIII). These complaints were present in 70 per cent of the mild cases, 81 per cent of the moderately severe, and in 85 per cent of the severe cases. The high percentage of these complaints lead to the more detailed examination of the stomach and intestines. The technique was that described in Part I. The results of these examinations showed no demonstrable inflammation in 10 per cent of the cases, a catarrhal inflammation in 69 per cent, and manifest ulceration in 21 per cent of the cases. In other words, the intensity of the jaundice was in proportion to the intensity of the gastric or duodenal inflammation. The fact that the complaints of the patients referable to the stomach ante-

dated the appearance of the jaundice by several days in nearly all cases would indicate that the cause of these so-called cases of "Acute catarrhal jaundice" has its origin in the stomach or duodenal portion of the gastrointestinal tract. Conversely, the liver is secondarily involved. It may be that the exciting cause, possibly a toxic substance, is ingested with the food, causing a gastritis or duodenitis, later to be absorbed and carried to the liver and excreted through that organ, producing parenchymatous changes which result in jaundice. It may be discharged into the intestinal tract (with the bile or otherwise), causing more irritation, then reabsorbed and reexcreted through the liver, thus accounting for the duration of the disease.

TABLE VIII.—*Symptoms, Comparing Groups* 1, 2, 3

Symptom	*Group 1 Per cent*	*Group 2 Per cent*	*Group 3 Per cent*
Complaints referable to the stomach	70.0	81.0	85.0
Pain in the abdomen (patient's statement)	30.0	36.0	43.0
Constipation	20.0	32.0	33.0
Vomiting	40.0	36.0	47.0
Dizziness	40.0	46.0	43.0
Weakness	70.0	57.0	76.0
Loss of appetite	40.0	68.0	52.0
Itching of the skin	10.0	30.0	19.0
Appearance of urine, light	60.0	71.0	86.0
Mentally clear (not "foggy")	80.0	57.0	52.0
Pus about the nasal pharynx	50.0	29.0	14.0
Liver enlarged	50.0	75.0	43.0
Tenderness on deep palpation*	0.0	11.0	38.0
Temperature above 98.8	30.0	38.0	57.0
Leucocytosis (above 10,000)	0.0	3.0	5.0
Leucopenia (below 8,000)	10.0	29.0	33.0
Eosinophilia	0.0	0.0	4.0
Red blood cells above 5,000,000	40.0	34.0	14.0
Red blood cells below 5,000,000	0.0	3.0	14.0
Anhydria (absence of free HCl) †	0.0	26.0	38.0
Hyperacidity (free HCl above 70)	0.0	1.0	14.0
Average total days of jaundice	17.3	23.9	26.0
Average days in hospital	9.9	15.5	16.9
Number of patients	10.0	69.0	21.0

* In the epigastric or right hypochondriac regions.

† Fasting stomach, first examination.

Pus was present in the mouth or upper respiratory tract in 50 per cent of the mild cases, 29 per cent of the moderately severe, and in 14 per cent of the severe cases. This pus had its origin from pyorrhea, sore throat, coryza, or bronchitis. Temperature above normal was an exception, but slight fever was occasionally seen during the course of the jaundice. There were no cases of continuous fever that could not be accounted for by some associated disease. It is believed that these cases of jaundice, when uncomplicated, ran a course without abnormal temperature. It is further believed that the results of the laboratory work, on the 13 typical patient sabove described, will exclude epidemic and infectious jaundice.

As described in Part I, the total acid and free acid figures of the fasting stomach, fasting duodenum, and the four fractional duodenal specimens were plotted and graphic charts made. After studying 138 such gastroduodenal curves on normal and jaundiced patients made immediately on admission to hospital, and after studying 42 such curves on these same patients before discharge from hospital, I offer the following types of curves as a basis for further study.

Type one: Normal curve. An example of this curve was shown in Part I. In its typical form, it is a "J" reversed. That is, the vertical portion of the "J" is the fasting stomach contents while the lowest portion is the fasting duodenal contents, the ascending portion then being the fractional contents. This outline was more generally formed by the total acidity than the free acidity line. Often the latter line was flat or even below zero commencing with the alkaline duodenal specimens. Variation from this normal were seen without any evidence of pathological change. The following varieties were often seen: (*a*) Acidity of the stomach contents, 10/20 (that is, free acidity 10 and total acidity 20) to 40/70, fasting duodenal specimen not over 10, and specimens 2 and 3 fractional duodenal contents not over 50 per cent of the stomach findings. (*b*) Acidity not over 70/90 in the stomach contents, fasting duodenal specimens not over 10/20 and fractional duodenal specimens 2, 3, 4, not over one-third of the stomach specimen.

Type two: Pathological curve, for gastric or duodenal ulcer. With free acid present in the stomach contents and the total free acid over 10, if either No. 2 or No. 3 fractional duodenal specimen (total acidity) exceeds 50 per cent of the stomach total acidity it indicates ulcer. This was present in 80.9 per cent of the ulcer cases of this series and was not present in any case not showing evidence of ulcer. The converse was not true; that is, all cases of ulcer, and more especially chronic cases, did not show this curve. The curve was not only found in jaundiced cases but also in other cases of acute or recent ulcer of the stomach or duodenum.

Type three: A curve suggesting chronic gastritis. The stomach acidity not over 6/10, fractional duodenal specimen not over 10, and not more than 4 points difference between the free and total acidity in the duodenal specimens. This curve was present in ten cases of chronic gastritis, four of which were under antisyphilitic treatment. This number also includes one case of acute yellow atrophy of the liver. Fig. 9 shows examples of these curves.

As the number of examinations in this series has been too small to form definite ideas, these curves are merely offered as suggestions for further study. Generally speaking, a flat curve indicates chronicity

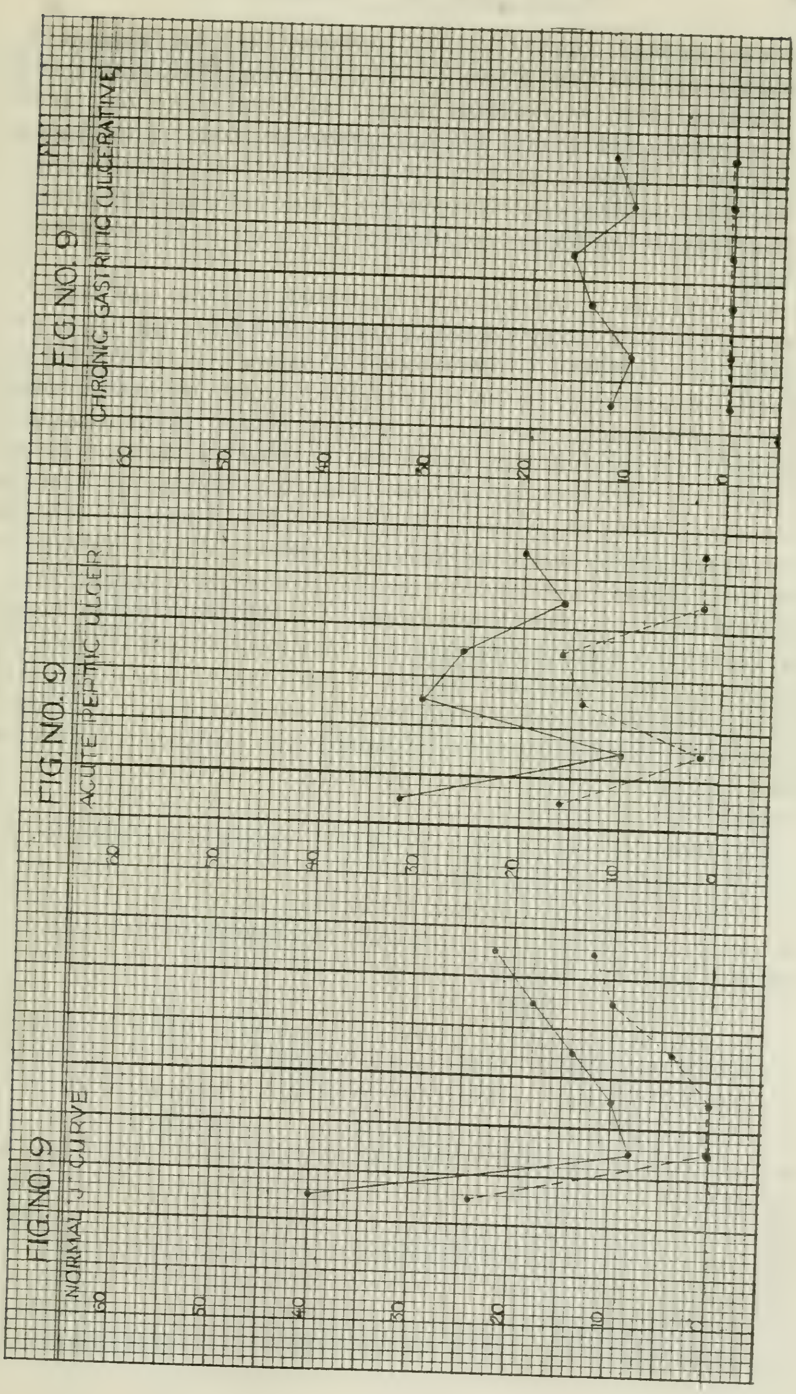
FIG. NO. 9
NORMAL "J" CURVE
60
50
40
30
20
10
0
FIG. NO. 9
ACUTE PEPTIC ULCER
60
50
40
30
20
10
0
FIG. NO. 9
CHRONIC GASTRITIS (ULCERATIVE)
60
50
40
30
20
10
0

(chronic gastritis), the "J" curve indicates that the stomach and duodenum are free from ulceration, and the curve resembling a septic temperature chart, as described above, indicates ulceration. In the "J" curve, the free acidity line runs generally parallel with the total acidity line or forms a flat or almost flat line in the duodenal end; that is, reckoning alkaline reactions as zero. Acute catarrhal inflammation of the stomach and duodenum affected the curves in no characteristic manner.

A Questionnaire and Physical Examination blank was shown in Part I. This was completed in each case. The following points were negative and furnished no information of value, i. e., abdominal distention, local swelling, edema of the feet and eyes, leucin and tyrosin crystals, neurological examination, malarial history (some cases gave a malarial history but their blood was continually negative for the plasmodium), evidence of epidemic jaundice, history of chemical poisons, and blood transfusion. The same is true for history of chills, fever, sweats, sleeplessness, and history of previous attacks of jaundice. The blood pressure was taken at three-day intervals in about 70 cases but furnished no information of value. The differential blood counts, also the red and white blood corpuscle counts and hemoglobin (Talquist) estimations furnished no information of value in so far as it concerned the jaundice. The blood estimations did show some anemia in about 17 per cent of the patients taking antisyphilitic treatment; however, this is believed to be due to the syphilis or its treatment and not to the jaundice.

The following points have to be very carefully explained to the patient in order to obtain reliable information: appearance of the stools, heart burn, "ball in the stomach," distress after eating, sour stomach, nausea, gas, alcoholic history, exposure to chemicals, "How long have you been sick or, jaundiced?" history of bad colds, sore throat, flu and exposure to cold and wet.

All cases were acute on admission to hospital—that is, none of the cases gave an accurate history of the jaundiced condition of the skin or eyes having lasted very long before entering hospital. Their complaints were of recent origin in general. As described above, only one case of jaundice received antisyphilitic treatment while jaundiced. An attempt was made to answer the following question: Did arsenic (antisyphilitic treatment) play any part in the cause of this jaundice? I am unable to answer this question in the affirmative; however, I believe that either the treatment for syphilis, the syphilis, or the two together prolonged convalescence. Table X shows the average number of days of jaundice and days of hospitalization in the three primary

groups of catarrhal jaundice subdivided into syphilitic and nonsyphilitic cases. It also shows the general average.

TABLE X. CONSOLIDATED AVERAGE DAYS LOST BY PRIMARY GROUPS

Group	*Syphilis*	*Nonsyphilis*	*Average*
(1)...........................	19.5/12*	16.7/ 8.9	17.3/ 9.9
(2)...........................	21.1/15.1	24.9/14.2	23.9/15.5
(3)...........................	24.1/13.2	27.4/19.8	26.0/16.9

*The first figures of the fraction, thus 19.5, indicate the *total* days, while the second figures (denominator) 12, indicate the days in the hospital.

It is interesting to note in Table V that the greater the pathological changes found in the gastroduodenal tract the higher was the percentage of syphilis present. Thus No. "1" (mild), 20 per cent syphilis, No. "2" (moderately severe), 34.8 per cent syphilis; and No. "3" (severe), 42.9 per cent syphilis. The degree of jaundice occupied an intermediary position of 69 per cent between the mild cases (10 per cent) and severe cases (21 per cent).

There were two deaths in this series, one due to acute yellow atrophy of the liver and the other to secondary hemorrhage following duodenal ulcer. The former was a class "3" (severe) case, while the latter was class "1" (mild). The liver of the latter case was unfortunately not examined microscopically, but was described macroscopically as being normal in size, pale in color, cutting with increased resistance, indistinct marking of the lobules, yellowish in color. Unfortunately it is not known whether necrosis of the liver cells was present or not; however, the general gross appearance suggested a strong similarity to the liver of the patient who died from acute yellow atrophy except in size and degree of changes. In other words, does not necrosis take place in the liver cells in acute catarrhal jaundice, and what relation does this disease bear to acute yellow atrophy of the liver? The fact that the former cases usually recover and the latter die is not a scientific basis for differentiation. Eppinger (1) reports the enormous regenerative faculties of the liver. He reports recovery of a rabbit, with regeneration of the liver, after two-thirds of this organ had been removed. It remains for the pathologist to determine the minute points of differentiation and similarity between these two diseases. Unquestionably points of clinical similarity exist.

In addition to the above two cases, there was one case of severe jaundice (class 3) operated on for bleeding duodenal ulcer. The ulcer was excised. Intensity of the jaundice was not increased following the operation. This patient was placed on ulcer treatment and made rapid improvement. He is performing full duty and is apparently well.

Treatment: For purposes of description, the treatment is divided

into five different kinds. These were not outlined from the beginning of the investigation but developed as the investigation proceeded.

1. *Medication.*—Calomel grains 2 on admission to hospital; magnesium sulphate (saturated solution in water), 1 ounce, twelve hours later. Sodium phosphate, ½ ounce in warm water once or twice daily to secure at least one bowel movement per day. The sodium phosphate was started on the second day after the calomel. Avoid purgation. After free purgation, the following was given three times daily (A. P. S.): dilute nitro muriatic acid, drops 10, pepsin grains 5, strychnine sulphate grains 1/50 in solution with aromatic elixir. Diet: The diet was liquid until the bowels moved freely and then the diet was soft. Fats were eliminated as well as most of the sweets. The patient's appetite was the guide for increasing the diet. Generally speaking, carbohydrates were increased, fats eliminated, and proteins reduced.

2. Same as number one plus quinine sulphate grains 10 t. i. d. in solution before meals. One patient improved so rapidly under this treatment, when he had not improved under the above alone, that the A. P. S. was discontinued on a series on ten patients. This constitutes the next form of treatment.

3. The calomel and salts were given as in number one. The A. P. S. was not given and quinine given as above described. This form of treatment was not a success. It was my opinion, after having used combinations of these treatments on 22 cases, that the patient made more rapid improvement without the A. P. S. and quinine.

4. On account of the large percentage of cases with gastroduodenal inflammation and ulceration, it was decided to try a modified gastric ulcer treatment as described by Sippy (2). I say modified because it was not necessary to continue the treatment in jaundice over such a long period of time as described in Musser & Kelly. When ulcer was present and the jaundice became cured, it was a matter of ulcer treatment. The cardinal points of the treatment were: rest in bed for one week, neutralization of the free acid in the stomach contents by alkali, frequent feedings in small amount, and the treatment of ulcer complications when present.

5. Eppinger of Vienna uses calomel (grains 3 daily) and animal charcoal (15 to 30 grains t. i. d.) alternately for six days. The charcoal is continued daily after the three calomel doses. The calomel is repeated if convalescence is not satisfactory. This treatment was combined with the dietetic treatment of increasing the carbohydrates, limiting the proteins, and removing fats that are difficult to digest as bacon. A limited amount of easily digested fats, as butter and cream, are given

after the calomel acts freely and bile present in the stools in about normal amount. Twenty cases received this treatment.

Table XI shows in detail the treatment of 85 cases by groups and kind of treatment. The remaining 15 cases of the 100 reported here received mixed treatments in such a manner that they can not be classified with the above. The following conclusions were drawn from the statistics and clinical progress of the cases:

TABLE XI.—*Consolidated Treatment by Group*
Irrespective of cause

Treatment No.	Group "1" Days of jaundice		Group "2" Days of jaundice		Group "3" Days of jaundice	
	Total	In hosp.	Total	In hosp.	Total	In hosp.
No. 1..........	18.5 (5)*	10.6	28.1 (27)*	19.0	26.5 (2)*	15.5†
No. 2..........	0 (0)*	0	36.4 (7)*	26.0	23.5 (2)*	18.0
No. 3..........	12.0 (2)*	8.0	26.2 (5)*	14.8	35.0 (1)*	33.0
No. 4..........	0.0 (0)*	0.0 (7)*	27.1 (7)*	15.1	33.3 (7)*	17.1
No. 5..........	15.5 (2)*	6.5	16.8 (11)*	11.3	30.5 (7)*	23.1

* Indicates the number of patients.
† The first figure indicates the total days, the second the days spent in hospital, i. e., 18.5/10.6.

First, patients progressed most unsatisfactorily under treatment 5 in all classes except class "3" (clinically these showed very slight evidence of ulceration; one case was a mild case and the other moderately severely jaundiced).

Second, progress was most rapid with treatment 5 in all classes except the ulcerative, class "3."

Third, progress was least rapid with treatment 3 in the ulcerative cases.

Fourth, progress was least rapid with treatment 5 in the ulcerative cases (except the one case treated by treatment 3).

Fifth, class "3," ulcerative, progressed most satisfactorily with treatment 4.

In addition to the dietetic and medical treatment described above, an attempt was made to drain the gall bladder with the duodenal sound as described in Part I. With the first three forms of treatment the gall bladder was drained at the time of the gastroduodenal intubation. These cases received but the one drainage; however, about 8 per cent

of them were treated locally with silver nitrate or permanganate of potash solutions. This solution was injected through the duodenal tube into the duodenum, retained a few minutes, and an attempt made to recover it. From one to four treatments were given on different days. I saw no improvement from this treatment. Those cases treated with treatments 4 and 5 received the initial gall bladder drainage and two additional ones on the two consecutive days. In addition, a fourth drainage was made on the tenth day of treatment. When hemorrhage was present, as was the case in three patients, or developed during the examination, as occurred once, further attempt at drainage was not made. It was not possible for me to determine positively the source of this bile or to differentiate it into "A," "B," or "C," bile as has been so often described in the literature. Gravel was obtained several times and on one occasion the "Old World" form of hook worm (uncinaria duodenale) was recovered through the duodenal tube. Progress was very slow in this case. After the hook worm was found and treatment commenced the patient made rapid recovery from the jaundice.

In my opinion there is no question but that the gall bladder can at least be partially drained with the duodenal tube. There are difficulties that surround it, and in 26 per cent of my examinations I feel reasonably certain that the gall bladder was not drained. However, in 74 per cent there appears to be but little doubt that the gall bladder was drained. In addition to the cases of jaundice, I had the occasion to attempt gall bladder drainage on five cases of acute cholecystitis. Three of these cases were post-typhoid fever cholecystitis. There were fever, pain, abdominal rigidity, and a palpable tender gall bladder. Following the gall bladder drainage, the tumor and pain disappeared almost instantly, also the rigidity. The temperature returned to normal by lysis. In the typhoid fever cases, the typhoid fever bacilli were recovered from the bile. Also after successful biliary drainage the jaundiced patients felt better. There were cases where gall bladder drainage would be unsuccessful on the first attempt and successful on the next, and vice versa.

The Widal liver functional test was made on 27 jaundiced patients. The results furnished no information of value. Since making the above tests, I have had the occasion to visit Vienna, Austria, and find the Widal test made at half-hour intervals covering a period of two hours, with an initial control instead of twenty-minute intervals, covering a period of one hour. This test is spoken of favorably in the medical service of the Franz Josef Spital, Vienna. The phenoltetrachlorphthalein test was not started until late in this investigation. It was

carried out nine times. It indicated a lowered function of the liver in five of the six cases of jaundice and was normal in three cases without liver involvement (normal persons).

Prognosis: Is the prognosis of the underlying cause of the condition, jaundice? Nearly all patients said that they felt "fine" after the third day of treatment. As improvement takes place, the tongue becomes cleaner, the jaundice less intense, the liver fraction becomes larger due to the reduction of the denominator, the tone and normal moisture of the skin returns, urobilin diminishes and later disappears from the urine and becomes strongly positive in the fresh stool. The appetite returns, especially for fats, and the foggy or dizzy feeling disappears. The patients' improvement ran parallel with the clearing of the tongue, skin and eyes, except those patients on ulcer treatment (Nos. 4 and 5). The tongue remained coated in these cases until the patient was taken off milk and cream diet. When the stools became strongly positive for urobilin, urobiligen, or bilirubin there was usually a noticeable improvement in the patients' condition. However, treatments 4 and 5 interfered with the bichloride of mercury test for bile in the feces, producing a negative reaction. Therefore, when the patients were on treatments 4 or 5, the tests were unreliable.

Judging from the results of the gastroduodenal intubation and the daily tests of the feces for bile, it is believed that all of these cases showed at least some obstruction to the flow of bile into the intestinal tract. The degree of this obstruction varied in different cases. When the stools became positive for bile, they usually remained positive and the amount of bile present gradually increased from time to time. However, this was not invariably true even with treatments 1, 2, and 3, as there were days when the tests were negative showing that bile was not present at least in the specimen of feces examined.

CONCLUSIONS

1. The cause of catarrhal jaundice is not known and the diagnosis is based upon the exclusion of all other forms of bile staining of the skin and conjunctivae. It is a symptom and not a disease.

2. Complaints of patients were referable to the stomach in 70 per cent of the mild, 81 per cent of the moderately severe, and 85 per cent of the severe cases.

3. Examinations of the stomach and duodenum gave no evidence of inflammation in 10 per cent of the cases. In 90 per cent, there was inflammation and 21 per cent showed manifest ulceration.

4. Syphilis was present in 35 per cent of the cases, and in these the jaundice was of longer duration.

5. The greater the pathological changes found in the stomach and duodenum the higher was the percentage of syphilis; thus No. 1 (mild), 20 per cent syphilis; No. 2 (moderately severe), 24.8 per cent syphilis; and No. 3 (severe), 42.9 per cent syphilis. The degree of syphilis occupied an intermediary position of 69 per cent between the 10 per cent mild and 21 per cent severely jaundiced cases.

6. Bacteriological findings were negative in the bile and blood in 13 typical cases. The following media were used; asitic broth, agar, human serum broth, asitic agar, human serum agar, and plain agar.

7. The season, occupation, and location appeared to play no part in the cause. Stuffed sausage, and possibly sour wines, are believed to have played an important part.

8. There was a marked clinical similarity between these cases of catarrhal jaundice and three cases of acute yellow atrophy of the liver that died in this hospital. The difference was one of degree.

9. The tongue, conjunctivae, skin, appetite, feces, and liver are the best guides to progress.

10. Gastroduodenal intubation and gall bladder drainage were of value in diagnosis and treatment. Liver functional tests require further investigation.

11. Gastroduodenal acidity curves offer a simple and apparently valuable aid in the diagnosis of inflammatory conditions of the stomach and duodenum.

12. There is no stock treatment for catarrhal jaundice. The underlying cause and associated conditions must be the basis of treatment. Generally speaking, cases showing ulceration progressed more satisfactorily with treatment 4; cases not showing ulceration, with treatment 5. All seemed improved with gall bladder drainage when successfully accomplished.

13. I am unable to state that syphilis played any part in the cause of these cases of jaundice: however, there seems to be no question but that it delayed recovery and increased the severity. Therefore it appeared advisable not to give these syphilitic patients arsenic and mercury while jaundiced, as done in antisyphilitic treatment.

14. The gross appearances of the sectioned liver in the cases of acute yellow atrophy and the case of catarrhal jaundice were macroscopically those of necrosis but differing in degree. Personally, I believe the underlying cause of the so-called catarrhal jaundice is a hepatitis which may be either mild or severe. It remains for the pathologist to determine the points of difference or similarity between these diseases.

15. I do not believe in the theory of the obstructed common duct as being the cause of catarrhal jaundice.

16. The dietetic history and the very high percentage of cases showing inflammation of the stomach and duodenum would indicate that the disease has its origin in this manner. It is further believed that the liver changes result from a toxemia. Stuffed sausage appears to be the most suspicious food.

17. Personally, I believe that the so-called salvarsan jaundice cannot be differentiated from the so-called catarrhal jaundice. This has a very important bearing in the military service.

In conclusion, I desire to express my appreciation to the Chief Surgeon, Col. Frank R. Keefer, M. C., the Commanding Officer, Station Hospital, Lieut. Col. Rubin B. Miller, M. C., and to the Chief of the Laboratory, Major Mathew A. Reasoner, M. C., for the valuable assistance rendered during this investigation.

REFERENCES

1. Wiener Medizinische Wochenschrift No. 7. 1922.
2. Practical Treatment, Musser & Kelly, Vol. IV.

PARLIAMENTARY PROCEDURE[1]

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THE transaction of business of whatever nature by groups of individuals has, with ever-increasing urgency, since the appearance of the first forms of democratic government in history, demanded adherence to some definite mode of procedure that might bring desired results and prevent the confusion which otherwise would be little less than chaos. The number of those otherwise well-informed and well-educated persons who are almost totally ignorant of the details of parliamentary procedure (if we except the form of address used in securing the attention of the presiding officer, and the words "I move") is so great as to be startling in a nation like this, whose basic ideal is individualism and the right of each citizen to express his opinion and to have his share in some sort of legislative activity. Only occasionally in a wide circle of acquaintances does one come upon a man or woman who has given the small amount of time and attention necessary for the acquisition of a fundamental knowledge concerning this particular subject. The fact becomes very apparent in the impromptu organization of societies for debate or for consideration of various legislative matters, even when those who take part therein have really a common purpose at heart.

As to the earliest origins of parliamentary practice it is probably not possible to speak with authority; but the organization and method of procedure of the Athenian Ecclesia is known in detail. The following is an interesting account of the legislative operations of this body:[2]

"The proceedings opened with formalities: the purification by the *peristiarchs*, who carried round slain sucking pigs; the curse against all who should deceive the people; the appointment (in the 4th century) of the *proedri* and their *epistates* (see Boule); the report as to the weather-omens. The assembly was always dismissed if there were thunder, rain or an eclipse. These formalities over, the *prytaneis* communicated the *probouleuma* of the council, without which the Ecclesia could not debate. This recommendation either submitted definite proposals or merely brought the agenda before the assembly. Its importance lay largely in the fact that it *explained* the business in hand, which otherwise must often have been beyond the grasp of a miscellaneous assembly. After the reading, a preliminary vote was taken as to whether the council's report should be accepted *en bloc*. If it was decided to discuss, the herald called upon people to speak. Any person, without distinction of age or position, might obtain leave to speak, but it seems probable

[1] Substance of a lecture delivered before the League of Nursing Education of the District of Columbia at Columbia Hospital, Washington, D. C., January 25, 1923.

[2] The Encyclopaedia Britannica, 11th Ed., Vol. VIII, p. 848.

that the man who had moved the recommendation previously in the council would advocate it in the assembly. The council was, therefore, a check on the assembly, but its powers were to some extent illusory, because any member of the assembly (1) might propose an amendment, (2) might draw up a new resolution founded on the principal motion, (3) might move the rejection of the motion and the substitution of another, (4) might bring in a motion asking the council for a recommendation on a particular matter, (5) might petition the council for leave to speak on a given matter to the assembly. Voting usually was by show of hands, but in special cases (ostracism, etc.) by ballot (*i. e.*, by casting pebbles into one of two urns). The decision of the assembly was called a *psephism* and had absolute validity. These decisions were deposited in the Metroon where state documents were preserved; peculiarly important decrees were inscribed also on a column (*stēlē*) erected on the Acropolis. It has been shown that the power of the council was far from sufficient. The real check on the vagaries of amateur legislators was the Graphē Paranomōn. Any man was at liberty to give notice that he would proceed against the mover of a given resolution either before or after the voting in the Ecclesia. A trial in a Heliastic court was then arranged, and the plaintiff had to prove that the resolution in question contravened an existing law. If this contention were upheld by the court, when the case was brought to it by the Thesmothetae, the resolution was annulled, and the defendant had to appear in a new trial for the assessment of the penalty, which was usually a fine, rarely death. Three convictions under this law, however, involved a certain loss of rights; the loser could no longer move a resolution in the Ecclesia. After the lapse of a year the mover of a resolution could not be attacked. In the 4th century the Graphē Paranomōn took the place of Ostracism (*q. v.*). In the 5th century it was merely an arrangement whereby the people, sitting as sworn juries, ratified or annulled their own first decision in the Ecclesia."

Again, the Roman Senate, the counterpart of the Athenian Areopagus, had evolved for itself a very definite mode of legislative procedure which remained quite unmodified throughout the whole period of the Republic and the first 300 years of the Empire.

". . . The right of summoning the senate belonged originally to the consuls, and later to the consuls, praetors, and tribunes of the plebs. In the Ciceronian period, when all these were entitled to summon the meeting, the right belonged to them in the above order of precedence. The magistrate who summoned the senate also presided and brought business before it. He first made statements to the house on important public affairs, and might then at his discretion ask the opinion of the house on points arising out of them, or invite other senators to speak without himself putting forward any definite proposition. In both of these cases he was expected to follow a regular order of precedence in asking for votes or speeches, and the magistrates of the year were precluded from expressing their opinion. When the chief senators had expressed their opinion on the motion of the president, or made proposals of their own, in the former case the house divided on the motion,

in the latter the president put to the house in succession the various proposals made. The only important modification of this procedure introduced by the principate was the extension of all the presiding magistrate's rights to the princeps, who, however, enjoyed also the right of giving his opinion as a private senator.[3]"

While, as is thus seen, the earliest models of parliamentary custom are to be traced from those civilizations which had their seats about the eastern portion of the Mediterranean, it is nevertheless probable that the legislative rules of our own time are much more definitely patterned upon those by which the English Parliament was governed even in its earliest days. This body traces its origin to Anglo-Saxon times, but during the 150 turbulent years which intervened between the Norman Conquest and the granting of the Magna Charta by King John in 1215, popular representation in government was as nearly nonexistent as such a principle could be and still survive. The whole history of parliamentary government in England has been marked in the last thousand years by those gradual changes in parliamentary methods that tended to diminish both relatively and absolutely the power of the throne and the nobility, and to increase proportionately that of the Commons.

Parliamentary law may be defined as "the general body of enacted rules and recognized usages which govern the procedure of legislative assemblies and other deliberative bodies." There are, of course, almost numberless details that sooner or later enter into the administration of any legislative organization, and only those who, like the Vice-President of the United States or the Speaker of the House of Representatives, are constantly occupied with the duties of a presiding officer, might be expected to remain always able to speak unhesitatingly and with authority concerning these details. It is only to the fundamentals of the subject and to certain important keystones in its superstructure that attention can be given in this description.

How are various deliberative bodies brought into being? The convocation and organization of the British Parliament, of the Congress of the United States, and of the various state legislatures and other analogous bodies, are, of course, provided for in the constitutions whose provisions these assemblies are charged with the duty of carrying out. But it is not with such groups that the average citizen has most to do. The single, incidental, or conditional mass-meeting is perhaps the best example of that type of group action which most interests the ordinary American. Incorporated bodies of various kinds (which, because they are incorporated, are subject to the scrutinizing eye of civil law) have

[3]The Encyclopaedia Britannica, 11th Ed., Vol. XXIV, p. 636.

a particular interest in seeing that their deliberations are pursued with due regard to the rules and regulations which have been adopted for their government, since disgruntled individuals or minorities may otherwise subvert the rule of the majority through a plea to the courts that proper legislative procedure was not followed and that the action of the assemblage was therefore illegal. Likewise, enactments making provision for the disbursement of moneys are matters of delicate concern, and may at any time become the subject of judicial investigation upon complaint of misappropriation of funds through failure in orderly procedure. In these and analogous circumstances courts of justice may be compelled to find for the petitioners, even when there is no reasonable ground for belief that the will of the majority was not actually in accord with the action taken. These considerations touch intimately the interests of physicians, dentists, and nurses, since many of their state, county and other local societies are incorporated, and since there is always to be found a financial element in the transactions of such societies.

But to return to the mass-meeting. In the convocation of such an assemblage there are two essential elements; (*a*) the summoning agent; (*b*) the method. It is in general customary for that imaginative person, to whom the necessity for discussion of and action upon any given measure of public or semi-public welfare has first occurred, to confer privately with a certain few friends relative to the advisability of calling a mass-meeting to debate this question. These individuals may very properly organize themselves into a committee, and as a matter of courtesy he who has first broached the subject is usually designated chairman. Such preliminary committee organization is not, however, essential, and it is perfectly feasible and within the limits of propriety for a single individual to act alone as the "summoning agent." The committee (or the individual) should decide upon the date, hour, and place of meeting, and should make all necessary arrangements to secure suitable accommodations, to see that the necessary light and heat are furnished, and otherwise to make sure that those who are to be summoned shall find the stage properly set upon their arrival. The news of this action must then be spread abroad among all interested persons. The medium of such communication may be the public press, the telephone, printed circulars distributed by mail, and in smaller communities the posting of notices in public places, such as the village postoffice, the general store, the trunks of trees about the village green, etc. The time may come when the radio broadcasting station will be called upon for the performance of a similar function. All such notices, whether distributed or posted, should have

the names of the self-appointed committee appended thereto, and it should be made definitely known that they constitute "the committee." It is a useful fiction for a single individual who may presume to call such meeting to sign his own name to the call and to subjoin thereto the phrase "for the committee." Such action adds, illegitimately, it is true, but none-the-less actually, to the prestige both of the notice and its writer.

At the appointed time, the constituent members of the assemblage having gathered together at the appointed place, the chairman of the committee calls the meeting to order with the time-honored formula "The meeting will please come to order." He should then state for the enlightenment of his hearers the matter with which they will be asked to deal, whose nature may be of the most varied. Before legal action can be taken by this public meeting it must elect its officers. The temporary chairman should announce this fact and should declare the chair in readiness to entertain a motion that the meeting proceed to the election of officers. A citizen in the far corner will arise and say, "Mr. Chairman" (the presiding officer of a committee or a temporary assembly is usually denoted as the chairman; permanent bodies, on the other hand, elect a president or speaker). The chair recognizes the gentleman in question either by pronouncing his name or by saying, "Mr. Smith has the floor." Mr Smith then says, "I move that we proceed to the election of officers." Another member is similarly recognized and says, "I second the motion." The chair then states the motion, saying, "It has been moved and seconded that we proceed to the election of officers," and he puts the question by asking, "Are you ready for the question?" Several voices answer from their places (without rising), "Question!" The chair then calls for a vote by saying, "Those in favor manifest it by saying 'aye'; those opposed 'no'." The result of the vote is next stated: "The ayes appear to have it, the ayes have it, the motion is carried. Nominations are in order for the office of chairman." A member arises and says, "Mr. Chairman." Being recognized he says, "I nominate Mr. Jones." Another member arises and, being recognized, says, "I second the nomination." Other nominations are made in the same way. After each nomination the chair asks, "Are there further nominations?" When the last nomination has been made the chairman will say, "There being no further nominations, the polls will be closed;" or a member may move that the polls be closed and such motion will be seconded, put, and carried in the usual way. The chairman then without further authority designates a sufficient number of tellers and instructs them to distribute blank ballots. He then says, "Prepare your ballots for one of the following candidates for

president," and reads the list of names of the nominees. The tellers without additional instruction collect the ballots as soon as they have been prepared, count them, and hand a written report of the result of the balloting to the chairman who immediately reads it. "Total number of votes cast, one hundred. Of these Mr. Smith has sixty, Mr. Jones has thirty, and Mr. Brown has ten. Mr. Smith, having received the majority of votes, is declared elected. Mr. Smith will take the chair." The other officers, usually a vice-chairman, a secretary, a treasurer, and sometimes an executive committee, are next chosen by similar methods. The chairman then requests, "Will someone please state the business of the meeting?" One of the prime movers of the affair in hand will usually have been designated to do this, and it now becomes his duty to put the matter at issue before the meeting in the form of a motion or of a resolution. If the latter be selected, it may very properly be preceded by a simple or compound preamble, each clause of which begins with the word, "Whereas." The subject for consideration having been thus brought before it, the assemblage now gives itself to discussion of and action upon the problem with due regard to certain fundamentals of parliamentary procedure which will be briefly outlined and described. Perhaps the fullest and most commonly used guide in all matters of general legislative activity in the United States is Roberts' "Rules of Order." This book contains within the first few pages a very valuable table of ready reference for presiding officers, in which may be found at a glance the answers to some three hundred questions concerning parliamentary practice. Of these rules those which may be looked upon as most fundamentally important are:

1. Before any subject may be debated it must have been moved and seconded, though the second may be omitted in certain cases. It must also have been stated by the chair; until such has been done it cannot be debated, for it is within the province of the chair to rule it out of order and to refuse to present it to the assemblage for consideration. (An appeal may of course be taken from this decision—of which more later.) The mover of a motion may modify it in any way he pleases, or may withdraw it entirely, before the chair has stated it; but after it has been stated, the mover can do neither without consent, since the motion is now looked upon as having become the property of the assemblage.

2. Ordinarily he who first arises and seeks recognition from the chair should be given the floor. There are certain exceptions to this rule:

(*a*) When a debatable question is immediately pending, the member who moved that question is entitled to be recognized first if he has not already spoken on it. If any member has already spoken on the question, he is not entitled to the floor again when some one else desires to speak on the same question. The interests of the meeting are best

subserved by allowing the floor to alternate between the champions and opponents of a measure.

(*b*) When an undebatable question is immediately pending, its mover has no preference to the floor.

(*c*) When no question is pending—that is, when *one of a series of motions* has been disposed of—the next motion in that series should be given preference, and any member desiring to speak on that motion should have preference over another member who desires to consider other business,—except that a member who rises to move to reconsider, to call up a motion to reconsider a motion previously made, or to take a motion from the table is entitled to preference.

3. When a member has the floor, he can only be interrupted under definite circumstances, of which the most important are as follows:

(*a*) By a motion to reconsider.

(*b*) By a point of order.

(*c*) By an objection to the consideration of the question.

(*d*) By a question of personal privilege.

4. Certain motions do not require a second. Of these, a question of personal privilege, objection to consideration, and a request that a motion to reconsider be called up, are three of the most important—though there are some eight or nine more.

5. Debate must in general be limited to the merits and demerits of the immediately pending question. There are few exceptions to this rule.

6. Certain motions may be made before the motion or resolution before the house (the immediately pending question) has been disposed of. Such motions are known as "secondary motions," and are subdivided into:

(*a*) Subsidiary motions. Examples of these are:

(1) To lay on the table.
(2) The previous question.
(3) To limit or extend the limits of debate.
(4) To postpone definitely.
(5) To commit or refer.
(6) To amend.
(7) To postpone indefinitely.

(*b*) Incidental motions. These include certain questions incidental to the business in hand that may arise, that displace the original motion or resolution, and thus become, until disposed of, the immediately pending question. Such incidental motions include:

(1) Questions of order and appeal.
(2) Suspension of rules.
(3) Objection to consideration.
(4) Division of a question and consideration by paragraphs or subjects.
(5) Division of the assembly and motions relating to voting.
(6) Motions relating to nominations.
(7) Special requests, such as for leave to withdraw a motion, etc.

(*c*) Privileged motions. These are motions which are of such transcendent importance as to justify their interrupting all other business.

They may be exemplified by the motion to adjourn, to take a recess, to raise a question of privilege, and others.

7. The more common motions are as follows:

(*a*) To amend.
(*b*) To commit.
(*c*) To postpone to a certain time.
(*d*) To make a special order (⅔ vote).
(*e*) To lay on the table.
(*f*) The previous question (to close debate) (⅔ vote).
(*g*) To limit debate (⅔ vote).
(*h*) Objection to consideration (⅔ vote).
(*i*) To move the previous question and to reject the question.
(*j*) To postpone indefinitely.
(*k*) To lay on the table.
(*l*) To take from the table.
(*m*) To reconsider.
(*n*) To rescind.
(*o*) To reconsider and have entered on the minutes.

Analysis of the foregoing tabulations indicates either directly or by implication that there are four kinds of motions, which are as follows:

A. Main motions. These are debatable, subject to amendment, and may have any subsidiary motion applied to them. They take precedence over nothing. When laid on the table they postpone or carry with them all pending or subsidiary motions. Main motions are subdivided into:

(1) Original main motions (used to bring entirely new business before the assembly.)

(2) Incidental main motions, of which a list is:

(*a*) To accept or adopt a report.
(*b*) To adjourn at or to a future time.
(*c*) To adjourn, if qualified in any way, or with no provision for another meeting.
(*d*) To appoint the time and place for the next meeting.
(*e*) To amend a constitution, by-laws, etc., already adopted.
(*f*) To ratify or confirm action taken.
(*g*) To rescind or repeal action taken.

B. Subsidiary motions. These are applied to other motions for the purpose of more appropriately disposing of them.

C. Incidental motions. Those arising out of another question which is pending. They take precedence of, and must be decided before, the question from which they arise. They yield to privileged motions and generally to motions to lay on the table. They are usually not debatable, and with certain exceptions they cannot be amended.

D. Privileged motions are those that are of so transcendent importance that they take precedence over everything else, although they do not relate to the pending question. Because of their privileged character they are always undebatable. Usually they cannot have subsidiary motions applied to them, though to this rule there are some exceptions.

The scope of this article would render inappropriate any attempt to give all the details regarding the handling of these various classes of motions. However, space may properly be taken for a list of motions not subject to amendment which will be found useful at the right hand of every presiding officer:

1. To adjourn (except when qualified or when made in an assembly with no provision for future meeting.)
2. To call for the orders of the day.
3. Question of order and appeal.
4. To object to consideration of a question.
5. To call for a division of the assembly.
6. To grant leave to withdraw a motion.
7. To grant leave to speak after indecorum.
8. Request of any kind.
9. To take up a question out of its proper order.
10. To suspend the rules.
11. To lay on the table.
12. To take from the table.
13. To reconsider.
14. The previous question.
15. To postpone indefinitely.
16. To amend an amendment.
17. To fill a blank.
18. A nomination.

The right to debate is an inalienable possession of every legitimate member of a legislative assembly, though certain restrictions are imposed thereon. Such right to debate cannot be cut off through dictatorial methods on the part of the presiding officer in stating questions and putting them to a vote so rapidly as to prevent individual members securing the floor. Debate must be at all times decorous, and personalities are to be scrupulously avoided. Debate must not reflect upon any previous action of the assembly, unless the debater announces his intention of moving to reconsider or rescind that action. It is a matter of custom in Congress to avoid the use of proper names, and to refer to the "Senator from Alabama" or the "Gentlemen from New York." Such custom obtains in greater or less measure in all deliberative bodies. The officers are referred to by their titles and not by names. The motives of individual members may never be called in question. The member who desires to ask of him who has the floor a question should arise and without waiting to be recognized should say, "Mr. Chairman, I desire to ask the gentleman a question." The chairman must then ask the debater whether he is willing to be interrupted. Such conversations by members must be carried on through the chairman since members cannot individually and directly address each other. The ethics of debate include many other principles and details.

There are certain motions that open the main question to debate and certain others which are not debatable. These respectively are as follows:

To open main question to debate:

- (*a*) To postpone indefinitely.
- (*b*) To reconsider a debatable question.
- (*c*) To rescind.
- (*d*) To ratify.

Undebatable:

- (*a*) To fix the time to which to adjourn (when a privileged question).
- (*b*) To adjourn (when unqualified in an assembly that has provided for future meetings).
- (*c*) To take a recess (when privileged).
- (*d*) To call for the orders of the day, and questions relating to priority of business.
- (*e*) Appeal when made while an undebatable question is pending, or when simply relating to indecorum, or transgression of rules of speaking, or to priority of business.
- (*f*) Suspension of the rules.
- (*g*) Objection to the consideration of a question.
- (*h*) Incidental motions, except an appeal as shown above in this list under "Appeal."
- (*i*) To lay on the table.
- (*j*) Previous question and motions to close, limit, or extend the limits of debate.
- (*k*) To amend an undebatable motion.
- (*l*) To reconsider an undebatable motion.

The methods of voting are:

1. Viva voce.
2. Show of hands.
3. Rising.
4. Ballot.
5. Yea and nay (roll call).
6. General consent.
7. Mail.

In questions in which a decision promulgated by the chair is at issue a tie vote sustains the chair. The duty of announcing the vote rests always upon the chairman, and he may, if in doubt on the viva voce vote, demand of the assembly that it vote in some one of the other ways outlined. In announcing the vote the chairman must always state whether the motion is carried or lost, what the effect or result of the vote will be, and what is the immediately pending question (or motion) after the vote has been taken. If there be no such pending question (or motion), the fact should be announced, and the chairman should request of the assembly, "What is the further pleasure of the meeting?"

It is a general rule that no one can vote on a question in which he has

a direct personal or pecuniary interest, but this does not prevent a member voting for himself for office, nor does it prohibit him from casting an affirmative vote for a measure in which he has a pecuniary interest when other members are concerned in the same measure, and have a pecuniary interest therein similar to his own.

A member has the right to change his vote up to the time when the vote is finally announced. After the announcement he can make such change only with the permission of the assembly, which may be given by general consent.

While it is the moral duty of every member to vote on every question, yet there is no parliamentary machinery for compelling members to do so.

The following motions require a two-thirds majority for their passage:

1. To amend (annul, repeal, or rescind) any part of the constitution, by-laws or rules of order previously adopted; it also requires previous notice.
2. To amend or rescind a standing rule, a program or order of business, or a resolution, previously adopted, without notice being given at a previous meeting or in the call for the meeting.
3. To take up a question out of its proper order.
4. To suspend the rules.
5. To make a special order.
6. To discharge an order of the day before it is pending.
7. To refuse to proceed to the orders of the day.
8. Previous question.
9. To limit or extend the limits of debate.
10. To extend the time appointed for adjournment or for taking a recess.
11. To close nominations or the polls.
12. To limit the names to be voted for.
13. To expel from membership; it also requires previous notice and trial.
14. To depose from office; it also requires previous notice.
15. To discharge a committee when previous notice has not been given.
16. To reconsider in committee when a member of the majority is absent and has not been notified of the proposed reconsideration.

The duties which pertain to the office of chairman are very exacting. This is of course true in the cases of all officers, but to the chair attaches a certain importance from the standpoint of equity and justice. The first law of chairmanship is absolute impartiality. Neither sympathy nor interest must be allowed to influence the action of the presiding officer. Upon him rests the obligation of seeing that the friends and foes of each measure are given adequate and honest opportunity to

record their arguments for and against the measure under debate, and he must so apply the principles of parliamentary law that the majority cannot tyranically abuse its privilege and override the rights of the minority. These duties pertaining to the chairmanship require in one who holds that office a peculiarly dispassionate temperament, in order that he may adhere always to the principles of fairness, even though such action may allow the passage of a resolution to which he is personally opposed, or the defeat of measures in which he is himself vitally interested. The chairman may upon occasion call another member (usually the vice chairman) to the chair, take a position on the floor, and indulge in debate. This, however, is rare, and is to be condemned, unless under very extraordinary circumstances, since it serves to indicate his own bias in the matter at issue and thus to divest him in the eyes of the assemblage of something of that impartiality with which he is supposed to be always clothed. The chairman must be uniformly courteous to all members of the assemblage, but firm, nevertheless, in enforcing his impartial decrees. The choice for chairman should always depend upon the known ability of a nominee as a parliamentarian and presiding officer. In certain instances presiding officers may legitimately call to their side some well-known parliamentary expert to assist them in unravelling a particularly tangled condition of legislative affairs, but such action will almost of necessity diminish the prestige of the chairman in that it will be taken as a confession of a certain measure of parliamentary inability on his part.

A useful familiarity with the essentials of legislative procedure which have been mentioned in this sketchy outline can be acquired with relatively little expenditure of effort and time, and will be found to be not only very useful, but the source, as well, of much satisfaction, to any man or woman who finds himself or herself called upon suddenly to preside over the activities of a deliberative body, or who, as a simple member of such body, desires to make his or her participation count most advantageously to the end that the business of the assemblage may be brought to as rapid and successful a conclusion as possible.

NOTES ON THE HYDROCHLORIC X OF THE BOVINE PARATHYROID

By ADOLPH M. HANSON, M.D.
Drs. Haessly, Hanson and Traeger, Laribault, Minnesota

A SOLUTION, prepared by boiling bovine parathyroid glands in hydrochloric acid, 10 parts per M of pure distilled water (designated as the *Hydrochloric X*), cooled and filtered, when added to concentrated aqueous solutions of calcium chloride, acid calcium phosphate, or calcium chloride and acid calcium phosphate gives a white precipitate. On adding a few drops of concentrated hydrochloric acid, the precipitate redissolves. A little of the precipitate, dissolved in dilute hydrochloric acid and rendered faintly alkaline by the addition of ammonia, gives a precipitate of calcium oxalate on the addition of a few drops of a 10 per cent ammonium oxalate solution.

On adding phosphotungstic acid to the *Hydrochloric X* an abundant white precipitate separates out. This precipitate is amorphous under the microscope and opaque to light. It chars on ignition and does not dissolve in concentrated hydrochloric acid. The Xanthoproteic and Millon's reactions do not take place. The precipitate obtained from fourteen glands cover a 5 by 7 inch glass plate when spread out evenly. It spreads as a perfectly smooth paste and has a faintly yellow color with transmitted light. On drying it is very much decreased in bulk, and when scraped off the glass plate is 0.15 gm. by weight and appears as a golden brown powder that sparkles like gold-dust.

CONCLUSION

1. The *Hydrochloric X* causes a separation of some of the calcium of concentrated aqueous solutions of calcium compounds in the laboratory.

2. A precipitate is secured by the addition of phosphotungstic acid, which, on drying, consists of a golden brown powder that may be preserved. This precipitate does not react as the proteins of the bovine parathyroids do.

NOTE: These Notes are presented as an appendix to "An Elementary Chemical Study of the Parathyroid Glands of Cattle." (Hanson: THE MILITARY SURGEON for March, 1923.)

ASSOCIATION NOTES

The next annual meeting of The Association, the thirty-first, will be held at the Army Service School, Carlisle Barracks, Carlisle, Penna., about the middle of October, 1923. It is believed that this will afford opportunity for an unusually instructive and entertaining program inasmuch as the resources of the school will be at the disposition of the attending members. Further announcement in regard to the details of the meeting will be made in an early issue.

STATE DELEGATES TO THE ANNUAL MEETING

Last October, for the first time in a number of years, there was a delegation from the National Guard present. This consisted of four members from the State of Maryland. The following states, twenty-four in number, have promised to send delegates to the coming meeting and it is probable that other states will also fall in line. This seems to show a healthy growing interest in the affairs of The Association by the National Guard which should naturally have much to gain from this Association since it was started as "The Association of Military Surgeons of the National Guard of the United States":

Maine	Vermont	Rhode Island
Massachusetts	Connecticut	New Jersey
Delaware	Pennsylvania	District of Columbia
Maryland	Virginia	North Carolina
Indiana	Ohio	Illinois
Wisconsin	Michigan	Missouri
New Mexico	Oklahoma	Arizona
Idaho	California	Florida

COMMENT AND CRITICISM

"CAMP ROOSEVELT—BUILDER OF BOYS"

The following brief excerpt is taken from the January issue of *Health* magazine.

Our public schools are broadening their activities. A few generations ago it was thought that the state had done its full duty if it provided a schoolhouse and a teacher. The building might be the "little red schoolhouse" of poetry and song. A one-room building, seated with rude furniture, heated by a sheet-iron stove in the center, with no toilet or sanitary accommodations, was thought quite sufficient. As for the children, the teacher was expected to take them the way she found them and teach them what she could.

Further on, in the same article, it states:

We have learned that something else is necessary for education besides a building and a teacher. The pupils must be prepared and qualified to receive the benefits of the education offered them, but many children of school age are hampered by physical defects. To expect a child with defective vision, who can only see a quarter as much as a normal child, to do the same amount of work in the same amount of time as a normal child is obviously absurd.

While physical education is now a part of almost every school curriculum, it occupies but a small part of the daily program, because of the many academic subjects which must be covered to round out the so-called general education. Realizing the need for more specialized instruction in physical education, the Chicago public school system has introduced a unique and altogether splendid plan for such instruction in the establishment of a great outdoor camp, where boys may assemble during the summer vacation months and go through an intensive course of physical upbuilding, and, at the same time, derive the utmost benefit from their camping experiences. The camp is under the direct supervision and command of Maj. F. L. Beals, U. S. A., who occupies the position of Supervisor of Physical Education in the Chicago public high schools.

Under Major Beals is an efficient staff, leaders who are men of character, trained to the work, selected, tried and proven. Some of these men are noncommissioned officers of the U. S. Army, assigned for this special duty by the War Department. Others are Y. M. C. A. secretaries, which organization maintains a "Y" hut, and eight or ten secretaries remain at the camp during the entire summer to look after the comfort and welfare of the boys. The American Red Cross, with its staff of doctors and nurses, achieves splendid results with its classes

in Red Cross and first aid, in addition to looking after the health and sanitation of the camp. The Chicago Dental Society representatives examine the mouth of every boy in camp and perform such remedial service as they can in the short space of time allotted them. The school faculty and athletic instructors are selected for their special fitness in dealing with boys from the Chicago public school system, under whose auspices the camp is conducted.

Prominent public-spirited Chicago citizens, under the chairmanship of Mr. Angus S. Hibbard, have formed the Camp Roosevelt Association, and the securing of funds to carry on this vast program is in their keeping. This whole-hearted support from affiliating organizations enabled boys who attend to receive the very best kind of training amid the choicest surroundings, at but a small percentage of the usual cost for such privileges.

To insure the best results in training, the camp is sufficiently far removed from the main thoroughfares as to provide absolute privacy, yet near enough to provide for the daily delivery of fresh fruits, vegetables and meats. The camp site is a picturesque one, on Silver Lake, Indiana, 8 miles east of LaPorte and 65 miles from Chicago on the New York Central Lines. It is easily reached from all directions.

The proper functioning of the mess hall in providing the very best edibles is assured by the assignment of a mess officer, who has under his direction twenty-one cooks, pastry cooks, vegetable cleaners and peelers, assistants, dishwashers, etc. The large mess hall, capable of accommodating one thousand at a time, functions with absolute perfection, and the end of each meal finds hundreds of healthy, growing lads happy and satisfied—a rather phenomenal record, when you stop to consider boys.

Where from seven hundred to a thousand boys congregate from fifteen or twenty states, and where they range in ages from ten to twenty, it will readily be seen that a program to cover so wide a range must necessarily be well regulated and diverse. Major Beals has met this need by dividing the camp into three sections; The summer schools, which include seventh and eighth grade subjects, and which are opeated on the same plan as are other Chicago public summer schools; the R. O. T. C. or military division, which offers splendid opportunity for outdoor activity; and the junior camp for the younger lad.

The better citizenship training enters into every phase of camp activity and is an undercurrent which is felt more than seen. All of the one hundred and more officers, instructors, etc., who compose the staff of the Camp Roosevelt organization start their instruction with the idea of "building better boys." Throughout their program, they

intersperse the training with better citizenhip ideals, and the end of the season finds these hundreds of boys ready to start back home with a well-defined knowledge of law and order, with respect for authority and the rights of others, and respect of self.

Major Beals is always glad to advise or assist parents of growing boys with their "boy" problems, and inquiries sent to his office at the Board of Education, 460 South State Street, Chicago, receive prompt response.

Camp Roosevelt offers the finest possible solution to the problem of proper training and recreation for the summer vacation period. Those of our readers who have growing sons, or who are interested in young boys, should take advantage of this opportunity, which provides every feature of the most exclusive camps at but a fraction of the cost.

The "Camp Roosevelt Idea" is being looked upon by educators throughout the country as the newest advance in the development of physical, méntal and moral education.

ADDITIONAL UNITS, ORGANIZED RESERVES

The following list of units of the Organized Reserves, has been authorized by the Surgeon General of the Army on the dates shown:

General Hospital No. 38	Jefferson Medical College Unit, Philadelphia, Pa.	Oct. 5, 1922
General Hospital No. 70	City Hospital Unit, Worcester, Mass.	Nov. 20, 1922
Veterinary General Hospital No. 4	Sixth Corps Area	Dec. 29, 1922
Evacuation Hospital No. 24	St. Vincent's Infirmary, Little Rock, Ark.	Jan. 3, 1923
Veterinary Evacuation Hospital No. 7.	Ninth Corps Area	Jan. 6, 1923
Veterinary Station Hospital No. 6	Seventh Corps Area	Jan. 6, 1923
Evacuation Hospital No. 22	Milwaukee Surgical Society Unit, Milwaukee, Wisc.	Jan. 15, 1923
Evacuation Hospital No. 1	Johns Hopkins Unit, Baltimore, Md.	Jan. 30, 1923
Evacuation Hospital No. 4	Washington University School of Medicine Unit, St. Louis, Mo.	Jan. 30, 1923
Station Hospital No. 7	Pennsylvania State Unit	Feb. 23, 1923
Evacuation Hospital No. 2	St. Luke's Hospital Unit, New York City.	Feb. 26, 1923

BOOK REVIEWS

Enlargement of the Prostate, Its History, Anatomy, Etiology, Pathology, Clinical causes, Symptoms, Diagnosis, Prognosis, Treatment; Technique of Operations, and After-treatment, by John B. Deaver, M.D., LL.D., Sc.D., F.A.C.S., John Rea Barton Professor of Surgery, University of Pennsylvania; Surgeon-in-Chief to the Lankenau Hospital, Philadelphia. Assisted by Leon Herman, B.S., M.D., Urologist to the Methodist Episcopal Hospital, Philadelphia; Assistant Surgeon to the Pennsylvania Hospital, Philadelphia; Instructor in Urology, University of Pennsylvania. 2nd Ed., with 142 Illustrations, 8°, 358 pp. Philadelphia: P. Blakiston's Son & Co., 1922.

The prostate gland consists partly of glandular elements and partly of muscle tissue. It is pale in color, firm in consistency, and lies immediately below the neck of the bladder surrounding the proximal portion of the urethra. With reference to the bony pelvis, it is placed below the inferior portion of the symphysis pubis and superior to the deep layer of the triangular ligament. Normally it is irregularly cone-shaped and approximates a horse chestnut in size. Transversely at its base it measures about 3.75 centimeters while its anteroposterior diameter is something less than 2 centimeters and its vertical diameter approximately 3 centimeters. Its weight is 18 grams. The supports which maintain this organ in position are (*a*) the anterior ligaments of the bladder; (*b*) the deep layer of the triangular ligament; (*c*) the musculae levatores prostatae, which are really no more than the anterior portions of the levatores ani muscles. A thin, firm, musculo-fibrous capsule surrounds the prostate and is firmly adherent to it. In fact it is structurally continuous with the stroma of the gland and is composed of tissues of the same sort—viz., unstriped muscle and fibrous tissue. Through it pass the urethra, which is situated along the junction of the anterior and middle thirds of the gland, and the ejaculatory ducts, which run obliquely downward and forward through the posterior portion of the gland and empty into the prostatic portion of the urethra.

The prostate may be properly spoken of as a structure accessory to the true generative organs. It secretes a viscid opalescent fluid which seems to be necessary for maintaining that degree of motility necessary in the spermatozoon to carry it far enough into the Fallopian tube to allow fertilization of the ovum. Experimental removal of the prostate gland in animals produces sterility but not impotence.

The anatomical relations of the prostate are of especial importance from two points of view. Surrounding, as it does, the urethra, inflammatory disease and other conditions, such an adenomatous enlargement, which lead to swelling or hypertrophy of the structure, tend, *ipso facto*, to interfere with or obstruct micturition. Again, the position of the gland immediately in front of the rectum offers a ready approach to the surgeon's examining finger and facilitates rapid diagnosis of hypertrophic changes. Such changes are of frequent occurrence in later life, and it has been estimated that beyond the age of sixty years hypertrophy of the prostate gland is present in such measure as definitely to interfere with voiding of the urine in one person out of five.

Dr. Deaver introduces his very complete chapter on the history of the enlargement of the prostate by inviting attention to the remarkable fact that "any part of the human body liable to such important pathological changes as the prostate gland should have acquired a conspicuous place in surgery within such comparatively recent years." He shows further that "the symptoms of prostatism, if we may believe Sir Everard Home, have been recognized from time immemorial," and that "this ingenious author surmised that the enlargement of the prostate gland met with so universally in old age is 'alluded

to in the beautiful description of the natural decay of the body, in the Bible, in the book of Ecclesiastes, the 12th chapter, the 6th verse, where it is written, "or the pitcher be broken at the fountain, or the wheel broken at the cistern," expressive of the two principal effects of this disease, the involuntary passing of the urine, and the total stoppage.'"

It was not until the earlier years of the 16th century that the presence of any such structure in the human organism was recognized, and the present century has seen at least the major portion of the development of prostatic surgery. To-day, however, the operative treatment of prostatic disease has been brought to so high a state of technical perfection in the hands of the most competent urological surgeons, that the inconveniences and dangers formerly attendant upon the senile hypertrophy of this structure have largely lost their terrors.

It is for the purpose of placing before the profession the history, anatomy, etiology, physiology, pathology, clinical causes, symptoms, diagnosis, prognosis, treatment, technique of operations, and after-treatment of enlargement of the prostate that Dr. Deaver gave to medical literature the book which forms the subject of this review. The author's name is accepted by the whole profession, both at home and abroad, as a guarantee of success in any such undertaking.

The attention of the reviewing eye is caught at once by the remarkably complete bibliographies appended to each chapter and by the diagrams and illustrations which represent all phases of the subject from embryological development of the genito-urinary tract through the anatomy, physiology and pathology to the operative treatment of prostatic disease in all its finesse. The book may safely be said to contain the last word on this subject.

A. N. Tasker.

Textbook of Anatomy and Physiology, for training schools and other educational institutions, by Elizabeth R. Bundy, M.D., formerly Adjunct Professor of Anatomy in the Woman's Medical College of Pennsylvania, and Superintendent of Connecticut Training School for Nurses, New Haven, etc. Fifth Edition, revised and enlarged, by Martha Tracy, M.D., Dr. P. H., Professor of Nutritional Hygiene, Woman's Medical College of Pennsylvania, Philadelphia, and Grace Watson, R. N., Educational Directress, Philadelphia General Hospital Training School for Nurses. With a Glossary and 266 illustrations, 46 of which are printed in colors. 8°, 442 pp. Philadelphia: P. Blakiston's Son & Co., 1923.

A valuable little manual of anatomy and physiology for institutions of nursing education, colleges, and high schools. It contains a compact glossary of scientific terms whose definitions are expressed with great simplicity. Of the 266 illustrations forty-six are in colors.

In the chapter on the physiology of digestion, which deals with food and its digestion and absorption, are to be found many references to the knowledge of nutrition acquired through the latest scientific research along that line.

Similarly, the recent developments in the subject of endocrinology are adequately treated in connection with the ductless glands, their physiology, their influence over metabolism, and their relation to disease.

The structure and physiology of the cell and a sufficiently detailed description of the histology of the individual tissues are contained in the introductory chapter.

The element of illustration is excellent, and all in all the book may well serve as a standard for those of its kind intended to present to students who are not pursuing courses leading to the degree of Doctor of Medicine the subjects of anatomy and physiology in their most comprehensible light.

A. N. Tasker.

A History of the Great War, by John Buchan. Four volumes, 600 pages each. Dark-blue cloth. Boston: Houghton, Mifflin Co., 1922. Price, $20 per set.

Enough time has passed since the Great War ended to permit the writing of an account of that great conflict that is fair to friend and foe alike. This we have in Colonel Buchan's work.

The author was trained at Glasgow University and at Oxford. To his legal training and experience he added two years as private secretary to Lord Milner when the latter was high commissioner in South Africa after the Boer War. At the outbreak of the World War he was a newspaper correspondent on the western front, serving later in the Intelligence Section of the General Staff of the British Expeditionary Forces in France, and during the last two years of the war was Director of Information for the British Government. Therefore Colonel Buchan was, throughout the war, in a unique position to secure detailed and authentic information regarding both military and diplomatic developments in all countries.

In his introduction, General Harbord, former Deputy Chief of Staff, U. S. Army, says:

> A characteristic of Colonel Buchan's work is its chivalric fairness even to the enemy, and the absence of that disagreeable tone of wisdom shown by many commentators who write in the light of after events. His conceptions of the strategy of the various theaters of the war are sound. The pictures of the great leaders are presented with fidelity. The national characteristics and racial idiosyncrasies of the various Allies are treated with tolerance and without visible bias.

The work is a clear narrative of one of the greatest epochs in the history of the world. It is charmingly written, printed from clear type on good grade of paper, and illustrated with 78 maps. There is also an appendix outlining the terms of the armistice with the Central Powers. As General Harbord says, "no person anxious to be informed on the war as a whole should fail to read it."

A Textbook of Pathology, with a final section on Post-Mortem Examinations and the Methods of Preserving and Examining Diseased Tissues. By Francis Delafield, M.D., LL.D., Sometime Professor of the Practice of Medicine, College of Physicians and Surgeons, Columbia University, New York, and T. Mitchell Prudden, M.D., LL.D., Emeritus Professor of Pathology, College of Physicians and Surgeons, Columbia University, New York. Twelfth Edition, Revised by Francis Carter Wood, M.D., Director of the Pathological Department, St. Luke's Hospital, New York, Director of the Institute of Cancer Research, Columbia University, N. Y. Seventeen full-page plates and 899 illustrations in the text in black and colors. 8°, 1,354 pp. New York: Wm. Wood & Co., 1922.

An attempt to practice medicine without a knowledge of pathology recalls nothing so vividly as the old saw regarding "the play of Hamlet with Hamlet left out." How an internist can properly interpret and evaluate the signs and symptoms of disease without a knowledge of at least the fundamentals of pathology is an enigma past solution. Yet many such Hamlets have been omitted from the medical drama in this and other countries. A pathologist of a certain large general hospital is fond of referring to an incident in his own experience which bears upon this matter. Being incapacitated because of a wound of the right hand for performing an emergency autopsy, he asked the chief of the medical service to replace him, since the case was one in which the latter had been much interested. This gentleman, universally considered a well-trained and painstaking internist, professed himself entirely willing to be of service, but made the very frank and very surprising statement that he had never done an autopsy in his life. It is probably true that considerable knowledge of pathology might be acquired without the individual in question

actually carrying through any post-mortem examinations, but the experience would be unusual, to say the least. The importance of the autopsy is very definitely recognized in the "Textbook of Pathology" by Dela field and Prudden, of which Dr. Francis Carter Wood is now editor, in that a separate a nd definite "Part III" has been given up to "The method of making post-mortem examinati ons and the methods of preserving and examining pathological tissues."

This work has long been a favorite with medical students in America, and the number of editions through which it has passed puts it very logically into the group of medical classics. A comparison of the present edition with the preceding one will bring to light the fact that numerous changes in text and illustrations have been made. Perhaps the greatest number of these—if they were to be actually counted—would be found in those sections of the book which deal with the pathology of tumors, with the diseases of the liver, and with neuropathology. The diseases and surgery of the nervous system have been very intensively investigated both by Americans and by scientists of other countries in recent years. The opportunities afforded by the war wounds received in Europe did much to stimulate this investigatory activity. It is a matter for American pride to dwell upon that much of the best of this work has been done by neurologists and pathologists of the United States. One indication of this fact is the frequency with which the names of Cushing, Dandy, and many others, appear in English, French, German, and Italian medical literature.

Omitting the previously mentioned third part of this volume, it is divided into the traditional "General Pathology" and "Special Pathology," the former including a consideration of all the general or elementary morbid processes (such as inflammation), together with the etiological factors in the production of disease, without distinct reference to the individual organs and tissues; while the latter concerns itself with the diseases and abnormities of the particular viscera and tissues. Pathology may, however, be otherwise subdivided. Thus we may look upon the consideration of those functional disturbances which are translated into "the symptoms of disease" as constituting "functional pathology." It is certainly this phase of the subject which more intensively intrigues the interest of the practicing physician and guides him in his work at the sick bed. The study of the structural changes which take place in the organism as a result of disease invasion is the other side of this picture and is denominated "morphological pathology." Since it deals with both the macroscopic and microscopic evidences of disease, it includes of necessity both pathological anatomy and pathological histology. It need not be said that these two modalities of the general subject are so closely interrelated that a consistent study of one involves an almost equally constant attention to the other.

The subjects treated under "General Pathology" include:

(*a*) The conditions of disease.
(*b*) Changes in the circulation of the blood.
(*c*) Regressive tissue changes.
(*d*) Progressive tissue changes.
(*e*) Inflammation.
(*f*) Animal parasites.
(*g*) Plant parasites.
(*h*) The relations of micro-organisms to disease—infection and immunity.
(*i*) The infectious diseases.
(*j*) Malformations.
(*k*) Tumors.
(*l*) The lesions induced by poisons.
(*m*) General diseases.
(*n*) The lesions in certain forms of death from violence.

while "Special Pathology" deals with:

(*a*) The blood and the blood-forming organs.

(*b*) The lymph-nodes.
(*c*) The spleen and thymus.
(*d*) The thyroid and adrenals.
(*e*) The circulatory system.
(*f*) The respiratory system.
(*g*) The digestive system.
(*h*) The liver.
(*i*) The urinary organs.
(*j*) The reproductive organs of the female.
(*k*) The reproductive organs of the male.
(*l*) Voluntary muscle.
(*m*) The bones and joints.
(*n*) The nervous system.

Dr. Wood makes interesting reference in his preface to the inadequacy of the alleged acquaintance with the more important foreign languages possessed by the average medical student. He makes the statement that, "despite the announcement that the average student possesses a reading knowledge of French and German upon entrance (as a medical matriculate), the actual amount of such knowledge when put to the test of practice often resembles most closely one of those imaginary quantities so current in the recent physical theories of time and space." In view of this consideration, many of the old German and French references have been replaced by corresponding ones in English, since "after all a reference is of little use unless it is going to be used." From the point of view stressed by the editor this change would seem to be a wise one. On the other hand, it is earnestly to be hoped that the "fake" knowledge of the modern languages attributable to so many of those who apply to medical schools for admission as students, may be made to give place to a practically serviceable ability to read French and German, to the end that the wealth of scientific material appearing in those languages may be made available to our future physicians at first hand.

A. N. Tasker.

Carriers in Infectious Diseases, A Manual on the Importance, Pathology, Diagnosis and Treatment of Human Carriers, by Henry J. Nichols, M.D., M.A., Major Medical Corps, U. S. Army; Instructor in Bacteriology, Parasitology and Preventive Medicine, Army Medical School, Washington, D. C. With a section on "Carriers in Veterinary Medicine," by R. A. Kelser, D.V.M., M.A., Captain, Veterinary Corps, U. S. Army; in Charge, Veterinary Laboratory, Army Medical School, Washington, D. C. 8°, 184 pp. Baltimore: Williams & Wilkins Company, 1922.

It is to the bacteriologist that the physician and sanitarian owe their present valuable knowledge regarding the status of carriers. The problem of the carrier is much more intricate and much more difficult of solution than any which deals only with the inanimate transmitters of disease, such as fomites. The latter may be rendered innocuous by simple sterilization according to some approved method. Not only can the human carrier not be subjected to brutal treatment of this sort, but even his segregation from those whom he menaces with infection has a medico-legal aspect that cannot be ignored, as courts of law have more than once ruled.

The investigation of the general subject of carriers has compelled a very considerable modification in the general concept of infection—its nature and pathology. Such studies have demonstrated that the clinical pictures of specific infectious diseases may vary all the way from the classical descriptions of typically severe cases to very slight reactions of which perhaps only serologic methods may give evidence. Upon the basis of this new conception carriers may be rationally classified in two groups. Of these, the first is composed of individuals whose infection has been so slight as entirely to have escaped notice

and who are, at the most, very transient carriers. The second group is that of the chronic carriers who are represented by individuals—former victims of the various infectious diseases—who after recovery continue to harbor and excrete the causative organisms of their respective maladies for many weeks, months, or even years. While the first group is sufficiently numerous to constitute a danger of no mean measure to the communities in which they live, nevertheless the chronic carrier is far and away the more important of the two in that it is he who forms the connecting link between former and present epidemics.

Carrier history may fairly be said to begin with the investigations carried on during the cholera epidemic that occurred in Germany between 1892 and 1894, wherein it was shown that persons who had recovered from a disease might, and in some instances did, continue to excrete virulent cholera vibrios from the intestinal tract for a variable length of time after clinical recovery.

Likewise it was learned during the same years that certain individuals who could give no history of a clinical attack of cholera similarly harbored and excreted the same organism. Ten years later Koch outlined a theory of epidemiological interest in connection with a possible typhoid carrier state, and as a result a very searching and altogether scientific inquiry into the origins and dissemination of typhoid fever in epidemics was undertaken. In the United States the trail of "Typhoid Mary" was uncovered by a group of bacteriological and epidemiological sleuths only a few years after Koch's pronouncement on the subject.

Koch's hypothesis maintained that while the typhoid patient was in the aggregate the most fruitful source of further contamination, yet the convalescent, and even the former patient who had been discharged from convalescence, were often responsible for many additional cases of the disease in question. In fact, as compared with the patient, they were to be looked upon as distinctly more to be feared from at least one point of view—namely, that their comings and goings and daily habits could not be controlled as in the case of the patient, and that they themselves thus constituted a more potent because unrecognized source of danger to those with whom they came in contact.

From those days down to the present the relative importance of carriers in disease has grown apace, and a very considerable volume of literature dealing with the subject has made its appearance. Thus, Major Nichols in his preface refers to the fact that in the Catalogue of the Army Medical Library there are to be found three hundred references to literature dealing with typhoid carriers alone.

In the manual by Major Nichols, to which has been appended a section on carriers in veterinary medicine by Captain Kelser, the prevailing motive is seen to be a concise description of present-day technical measures applicable to the diagnosis and treatment of carriers. To that end the style is simple and calculated to give to one making his first ventures in this field definite and precise directions concerning each step in proper and logical order. On the other hand, it is presupposed that the worker is already a trained bacteriologist and at least something of a pathologist, so that the details of bacteriological technic and methods have been omitted. For example, on page 53 are to be found the sentences, "The duodenal contents are spread directly on Endo plates. Some of the specimens should also be incubated for twenty-four hours and other plates inoculated"; but nowhere in the book is the preparation of Endo's medium described.

After the preface, in which the purpose of the book is put down and reference is made to those personal experiences of the author from which he has drawn his material, and an introduction, in which carriers are classified and their various groups are briefly described, the subject proper is introduced by Part I, which is given up to "General Considerations." These general considerations include the importance of the subject, the pathology of carriers, the adequate diagnosis and treatment of carriers. Part II deals with carriers of individual diseases which are treated in the following order:

(*a*) The Typhoid Fevers.
(*b*) Cholera.
(*c*) The Dysenteries.
(*d*) Helminthoses.
(*e*) Diphtheria.
(*f*) Epidemic Meningitis.
(*g*) Pneumococcus Pneumonia.
(*h*) Streptococcus infections.
(*i*) Other respiratory infections including Influenza, Vincent's Angina, Tuberculosis, and diseases of unknown etiology or due to filterable viruses.
(*j*) Blood diseases of which Malaria is the only one discussed in detail.
(*k*) Sexual diseases.
1. Syphilis.
2. Gonorrhea.
3. Other venereal diseases.

Part III summarizes the whole subject and includes a summary of rules for the carrier himself, which is so important and at the same time so concise that it is quoted in full:

(*a*) For faecal and urinary carriers:
1. Deposit feces and urine only in places provided for such a purpose and not where they can knowingly infect a water supply.
2. Wash hands with soap and water after going to the toilet. Use individual paper or towel.
3. Wash hands before each meal. Use individual eating utensils.
4. Do not engage in food handling occupation.
5. Disinfect soiled underclothing in 5 per cent carbolic acid solution.
6. Do not use common bath tub; use sponge or shower bath.
7. Report to physician for periodic examination.
(*b*) For the respiratory carrier:
1. Dispose of discharges from nose and throat in a safe way, in spittoon or handkerchiefs. Do not spit promiscuously.
2. Use personal eating utensils.
3. Wash hands when soiled with respiratory discharge. Use individual towel.
4. Avoid close contact in talking; avoid kissing.
5. Report to physician for treatment and regular examinations.
(*c*) For genito-urinary carriers:
1 Avoid sexual intercourse, unless with protection.
2. Do not marry without permission of a physician.
3. Take treatment.
4. Have periodic examinations.
(*d*) For the blood carrier:
1. Avoid bites of mosquitoes by screens and bed nets.
2. Kill mosquitoes found in room.
3. Follow lines of treatment.
4. Have periodic examinations.

The fourth part deals with carriers in veterinary medicine. It is subdivided into "Carriers of organisms pathogenic for both man and the lower animals," "Carriers of organisms pathogenic for lower animals and possibly for man," "Carriers of organisms pathogenic for lower animals only." These three subdivisions are in turn appropriately subdivided into sections which deal individually with the various pathogenic microorganisms.

Comparison of this book with those dealing with the same subject to be found in the Army Medical Library shows that it has a field of its own, in that it gives itself up almost entirely to the mission of a laboratory manual. Other works on the subject contain, it is true, certain laboratory directions, but they deal more largely with the epidemiological and public health aspects of the question. Major Nichols' work, on the other hand, subordinates these phases of the problem to that of the actual laboratory diagnosis and treatment of the carriers. The bibliographies which follow appropriate chapters are interestingly complete without being too voluminous. The physical get-up is all that

might be asked for, and as previously referred to, the style and arrangement are such as to make the work one of ready reference for the laboratorian who must often look for specific directions while actually engaged in manipulative procedures with his hands. It is not possible to find adequate ground for adverse criticism, but if any suggestion were to be offered, it would be that the number of illustrations be increased. Experts often fail to realize the measure in which the ordinary, common garden variety of laboratory worker gleans ideas which amplify the text from even the simplest illustrations. Possibly a certain expansion of this element of the book might enhance its value for those who have had less experience in carrier work than has the author.

"Carriers in Infectious Diseases" should most decidedly be in the hands of every bacteriologist, protozoologist and sanitarian. No one of them can fail to secure valuable assistance from it in reference to carrier problems with which they may be confronted. Not only so, but the clinician, who first sees the patient, might well give a few moments of his time to the perusal of the pages dealing with the individual infectious diseases as he comes in contact with them, and thus inform himself regarding a side of medicine with which he is all too apt to be unfamiliar, and which many physicians fail properly to evaluate.

A. N. Tasker.

Medical Diagnosis for the Student and Practitioner, by Charles Lyman Greene, M.D., St. Paul, Lecturer in Applied Anatomy, University of Minnesota, 1892–4; Professor of Applied Anatomy and Instructor in Clinical Medicine, 1894–7; Professor of Clinical Medicine and Physical Diagnosis, 1897–1903; Professor of the Theory and Practice of Medicine, 1903–9; Professor of Medicine, Chief of the Department of Medicine and Chief of Medical Clinic in the University Hospitals, 1909–15; Author of the Medical Examination for Life Insurance and its associated clinical methods; Attending Physician, St. Luke's Hospital and Miller Hospital; Consulting Physician, State Hospital for Crippled and Deformed Children; Member of the Association of American Physicians, American Therapeutic Society, etc., etc. Fifth Edition, revised and enlarged, with 14 colored plates and 623 other illustrations. 8°, 1,453 pp. Philadelphia: P. Blakiston's Son & Co., 1922.

Of diagnosis Hippocrates says:

> In disease one learns to deduce diagnostic signs from the following considerations: From human nature in general, and from the complexion of each individual in particular; from the disease; from the patient; from medical prescriptions; from him who writes the prescriptions, for these may very well suggest the fears or the hopes (of the physician); from the general constitution or the atmosphere; from the particular conditions obtaining in the heavens and in each country; from the customs of that country; from the alimentary regime; from the mode of life; from the age of the patient; from discussions, and from the differential points brought out by them; from the patient's silence; from the thoughts which occupy the patient; from his sleep; from his insomnia; from his dreams, according to their nature and the time at which they manifest themselves; from the movements of the hands; from the tears; from his itchings; from the nature of the paroxysms; from the feces; from the urine; from the sputum; from the vomitus; from the reciprocal relations which exist between diseases, and from the crises which point toward the loss of the patient or a favorable outcome; from perspiration; from chills; from shivering; from cough; from sneezing; from hiccough; from the character of the respiration, from eructation; from hemorrhages; from hemorrhoids; and from fever. The physician must know how to study all these signs and to understand what they indicate.

An understanding of the difficulties of diagnosis is by no means a modern concept.

The fifth edition of Dr. Greene's book on "Medical Diagnosis" shows by comparison with the fourth edition that no effort has been spared to include and evaluate all of the later diagnostic methods. Some of the more important differences between the two editions may very properly be made the subject of remark:

1. The two tests of Goetsch for hyperthyroidism are defined and interpreted on pages 181 and 182 of the new edition.

2. The section dealing with the Roentgenographic examination of the lungs and pleura has been expanded from an article of eight pages in the earlier edition to one of twelve pages in the later.

3. On page 426 of the new edition has been added a paragraph dealing with dermoid cysts of the lung.

4. The rapidly increasing knowledge regarding the importance of circulatory diseases as causes of early invalidism and death is acknowledged in the very considerable amplification of that portion of the work dealing with the heart and blood vessels.

5. A section of several pages has been given up in the new edition to the "marking and interpretation of the polygram." Workers in heart stations will thoroughly agree with the author's statement that in order to secure information of real value from the polygraph "it is absolutely necessary to proceed in a systematic and orderly manner in the marking and interpretation of a polygram."

6. The sections dealing with electrocardiography and the cardiac arrythmias have been very largely rewritten, and a great amount of new material evolved as the result of circulatory study during the period of the world war has been included, while a certain amount of less essential substance has been omitted as between the two editions.

7. Similarly the application of Roentgenology to the diagnosis of cardiac disease has been much more extensively treated, and there have been added numerous Roentgenograms dealing with cardiac abnormities.

8. The section on myocardial overstrain now contains Roentgenograms and venous pulse tracings illustrating the information which one may hope to discover concerning this condition by the use of these diagnostic measures.

9. It could be wished that the author had included in the section on infection and immunity references to some of those later modifications and substitutes for the Wassermann reaction which are being so much written about at the present time—namely, the methods of Sachs-Georgi and Meinicke, of Gaté and Papacostas, of Dold, and of others. Dr. Greene perhaps, however, believes that these procedures have yet to prove their worth, and that it will be time enough to include them in the 6th Edition.

10. The section on influenza has been revised and greatly amplified and to it has been added a series of Roentgenograms illustrating the hemorrhagic pneumonias of influenza, together with a very illuminating quotation concerning this complication from John Hunter Selby's article in the *American Journal of Roentgenology*, 1919, volume 16, page 211.

11. A half page is devoted to the tularemia of Francis.

12. The description of trench fever has grown from twelve lines to a full page.

13. The author has not neglected to give a very satisfactory account of encephalitis lethargica, which did not appear at all in the fourth edition.

One of the most noteworthy features of this book is the wealth of illustration which accompanies the printed text. The colored plates are exquisite productions. In its scope the work is extraordinarily complete, and fully justifies the title of "Medical Diagnosis" which has been given it. It is without doubt one of the most valuable works of general reference both for the student and the internist that American medical literature has produced.

A. N. Tasker.

History of the Great War, based on Official Documents, Medical Services. Diseases of the War, Volume I. Edited by Major General Sir W. G. Macpherson, K.C.M.G., C.B., Major General Sir W. P. Herringham, K.C.M.G., C.B., Colonel T. R. Elliott, C.B.E., D.S.O., and Lieutenant Colonel A. Balfour, C.B., C.M.G. London: His Majesty's Stationery Office.

As classified by chapters the subjects considered in this volume are:

The military operations of the British in the World War were conducted in many widely separated regions under very different climatic conditions and, as was to be expected, there was great variation for the different localities in the incidence of disease in general, and even more so of individual diseases. For instance, it is shown that while admissions for disease in France were less than twice as numerous as for wounds, the admissions for disease, in the other theaters of war, exceeded those for wounds 14.6 times. In the operations in Macedonia during 1917–1918 there were over 26 times as many admissions for disease as for wounds. This is accounted for, to a certain extent, by the immense number of wounded in France as compared to the other places, but even this fact will not wholly account for the different ratios.

Local conditions in the various countries in which the war was fought played a prominent part in the determination of the particular diseases which would be most prevalent. While during the entire war nephritis was constantly present in France, it is not mentioned in the vital statistics from other countries. Likewise, trench fever was not generally prevalent except among the troops in France. On the other hand, the enteric fevers, dysentery and malaria prevailed in greater degree in the outlying seats of war than in France. In fact in East Africa the admission rate for malaria was approximately 25,000 times higher than in France.

In the first chapter the author lays especial stress on the importance during active warfare of diseases caused by dirt or by lice. While the standard of sanitation, in so far as related to water supply and disposal of excreta, was excellent, sanitary requirements in other respects were not always satisfactory. The overcrowding of men in dugouts and cellars, where they could only change clothing or bathe at infrequent intervals (and where they had to eat under conditions which were often objectionable), was unquestionably responsible for a large increase in the sick rate with the consequent wastage of man

power. The author also urges that in future planning of campaigns the opinion of medical officers regarding the best methods of avoiding the enormous wastage through sickness be given thorough consideration by the General Staff.

Under the term "enteric group of fevers" is considered typhoid fever and paratyphoid A and B fevers, as well as a certain number of cases in which, for various reasons, accurate bacteriological or serological diagnosis could not be made. From the statistical data given there can be no doubt that the incidence both of typhoid fever and the paratyphoids was greatly reduced by the systematic administration of the triple vaccine. A greatly lessened case mortality rate was also noted among those protected by inoculation as compared with the unprotected. A study of the statistics also indicated that the fatalities in paratyphoid A were greater than in paratyphoid B.

The relative incidence of the various types of dysentery among the British forces varied according to the climatic conditions of the areas in which the troops operated. Amebic dysentery constituted about 7 per cent of all clinical dysenteries in the eastern theaters of war, while in France the rate was only 2.8 per cent.

The highest proportion of amebic infection was noted in Mesopotamia, where in the forward areas 20 per cent of the acute dysenteries among the British troops were amebic while the rate was almost doubled among the Indian troops. In the base area the rate was higher, reaching 40 per cent for the British troops.

Bacillary dysentery was, of course, in evidence in all the war zones, but to a greater degree in the eastern areas. It constituted about 90 per cent of all dysenteries reported.

The fact that flies play an important part in the transmission of bacillary dysentery is emphasized. At one camp in Mesopotamia 63 per cent of the flies caught had human feces in the intestinal canal. In connection with the transmission of the disease through water, reference is made to the demonstration that water which has been properly chlorinated may again become infested when the effect of chlorination has worn off.

The results accruing from the preventive measures employed to combat typhus fever are clearly shown in the freedom from this disease enjoyed by the British troops. In France and Italy there were only five cases during the entire war, while in the eastern countries where the British army was operating, although typhus fever was often epidemic, the rates of incidence among British troops were invariably small.

Cerebrospinal fever was much more prevalent among the troops in England than among those in France. The important rôle played by carriers in the transmission of this disease has long been recognized, and a marked factor in increasing the number of carriers was determined during a study made at a mobilization depot in 1917. It was found that when the distance between beds was 3 feet the carrier rate rarely exceeded 5 per cent. When the distance between beds was reduced to 1 foot 4 inches the carrier rate was 10 per cent. With an inter-bed space of 1 foot the carrier rate rose to 20 per cent, and at less than 9 inches the rate was 28 to 30 per cent. The great value of this study to military sanitary officers in demonstrating the danger of overcrowding is clearly apparent.

The experience of England relative to influenza was similar to that throughout the world. The disease was prevalent in 1916 and 1917, and in the great epidemic of 1918 there was an especially high admission rate during the months of June, July, October and November. In general the incidence among the troops at home was greater than in France, but during the months of November and December, 1918, and January, 1919, the opposite prevailed. During 1918 there were also many admissions for influenza in the eastern theaters of operation. From the figures given, it appears that influenza in the British army as a whole was not nearly so prevalent as among our forces. A difference in diagnostic nomenclature may, however, be responsible in part for this seeming difference in incidence. It is estimated that approximately 20 per cent of all influenza patients

developed a "pneumonic" complication and of these about 40 per cent died; these ratios are quite similar to those noted in the American army. Mention is made that empyema as a complication was uncommon in France, and that it is not even referred to in the reports of the influenza epidemic in England.

A special section is devoted to a disease which was called purulent bronchitis and was classed as a separate clinical entity. This affection prevailed among the troops in France as well as in England. This disease was marked by a variety of clinical symptoms. There was either an acute or a slow onset. Cough and dyspnea were present. The sputum was very abundant, of a greenish or greenish-yellow color and purulent in character. The temperature rarely rose above 103°. The pulse was rapid. The course of the disease was persistent, the fever frequently continuing for three to six weeks and disappearing by lysis. The physical signs were atypical, but in general fine râles and crepitation were noted with impairment of the breath sounds. Signs of consolidation were usually absent. The bacillus of influenza was usually present in the respiratory excretions, but no mention is made of purulent bronchitis as a complication or sequalae of clinical influenza.

It is surprising to note that "of all diseases responsible for casualties during the war malaria probably holds first place." This is, of course, due to the fact that so many of the operations in which British troops participated occurred in tropical and semitropical countries. During the years 1916, 1917 and 1918 there were approximately 160,000 admissions for malaria in Macedonia, 35,000 in Egypt, 107,000 in East Africa, and 20,000 in Mesopotamia. In addition there were numerous admissions in the Cameroons, South West Africa, France and England. Unfortunately the types of malaria are not given, but, from the character of the countries involved, malignant tertian must have occurred frequently. Examination of about 40,000 positive blood films in Macedonia showed practically an equal incidence of the benign and malignant tertian types. The quartan plasmodia was rarely found in any region.

The chapter on trench fever gives a thorough review of the studies made concerning this disease but brings out no new facts. For many reasons it was impossible to give the incidence rate of trench fever.

A number of cases of spirochaetal jaundice or spirochaetosis ictero-hemorrhagica were observed among soldiers in France, the exact number not being given. The mortality is estimated at 4 to 6 per cent, much lower than that stated by Japanese observers.

Scurvy occurred in the various zones of operations, especially among the Indian troops. In Mesopotamia over 14,000 cases were recorded among Indian troops during the years 1916, 1917 and 1918. In every instance investigation revealed that an improper or insufficient ration was responsible. When a proper diet was provided and eaten the disease disappeared. Similar conditions were found to be responsible for the few cases of beri-beri which were noted.

Famine dropsy, a condition characterized by edema, polyuria, bradycardia and asthenia, was observed in places where a sufficient diet could not be secured, principally among the civilian populations. The edema began in the feet, ankles and dependent parts and often extended over the whole body even to the hands and face. This condition was not observed among British soldiers until after the armistice, when many cases were seen among soldiers released from German prison camps. They were soon cured by good care and feeding.

The subject of nephritis as it occurred during war is of interest. At first, cases of this disease were called "trench nephritis," but later it was noted that such cases were not restricted to men serving in the trenches and the term "war nephritis" was sub-

stituted. While it could not be regarded as proven that war nephritis was a disease distinct and separate from other forms of nephritis, the number of cases which occurred during service in France as compared with the incidence under normal conditions made such a distinction seem proper. The great majority of the cases cleared up in a short time, though a small number became chronic.

The concluding chapter deals with disorders of the cardiovascular system. After reviewing the work of Mackenzie, Lewis and others, the statement is made: "the results thus obtained may be said to have placed the whole subject on a completely different footing and to have produced a standard of knowledge higher than was previously attained." Shortly after the onset of the war it become evident that many diagnoses of valvular heart disease were being made among men who had no real organic lesion. A study of many cases was made by heart specialists, and it was determined that the diagnosis of a valvular heart disease could be made only after a thorough observation of each case. Murmurs, especially systolic murmurs, were in themselves entirely insufficient evidence on which to base such a diagnosis. This is thoroughly in accord with the conclusions of our medical officers.

Considerable space is given to the consideration of a condition known as disordered action of the heart (D. A. H.), effort syndrome, or, according to our nomenclature, neurocirculatory asthenia. The large number of patients afflicted with this condition who came under the observation of the heart specialists afforded abundant material for a study of all phases of this condition. The etiology of effort syndrome was difficult to determine, so many underlying causes apparently entering into consideration. In the majority of cases, however, a distinct history of severe physical and mental strain preceding the onset was obtained. The determination was reached that soldiers thus affected required rest in a special hospital (or preferably in a convalescent depot) outside the zone of active operations followed by a course of graduated physical exercises. Followin treatment of this character, the great majority of the patients were able to return to duty of some character, most of them to full duty.

The authors of the various chapters of the volume were selected from the lists of regular and temporary medical officers who were especially well informed in the respective subjects. For this reason each chapter can be regarded as authoritative and representing the latest developments on the particular condition under consideration.

It is unfortunate that complete statistics were not available showing the exact incidence of each disease, but the difficulties in the way of tabulating and presenting such data can be readily understood.

One criticism which may be made is that portions of many of the chapters are written in the present tense rather than in a historical vein and that much of the text discusses such topics as etiology, symptoms, pathology, prognosis, and treatment of diseases in a manner which would appear more fitting for a textbook of medicine rather than for a history of the professional activities of the Medical Department in the War.

The entire volume is excellent and brings out in a clear and concise manner the high character of the work done by the professional services of the Royal Army Medical Corps. It should be read by all physicians, whether connected with the military service or not. Much of the text will also be of great value to the laymen, especially to those interested in hygiene and preventive medicine.

Copies of this and the other volumes of the British Medical History of the War can be obtained from His Majesty's Stationery Office, Imperial House, Kingsway, London, W. C. 2. The price of this volume is one pound two shillings.

History of the Great War, based on Official Documents; Medical Services; Surgery of the War, Volume II. Edited by Major General Sir W. G. Macpherson, K.C.M.G., C.B., LL.D., Major General Sir A. A. Bowlby, K.C.B., K.C.M.G., K.C.V.O., Major General Sir Cuthbert Wallace, K.C.M.G., C.B., and Colonel Sir Crisp English, K.C.M.G. London: His Majesty's Stationery Office.

In the second of the two volumes of the British Medical History of the War devoted to surgery, the subjects considered concern injuries of the various special regions of the body, the more general aspects of the surgery of the war having been considered in the first surgical volume. The medical profession well knows that marked surgical advances were made in the treatment of wounds during the World War, and in this volume the work of the British surgeons is admirably and authoritatively set forth.

In this volume, as in the first, on surgery, each chapter was written by one or more surgeons of well-recognized preeminence in the particular field which is covered.

The subjects by chapters are as follows:

I. Gunshot Wounds of the Head.
II. Injuries to the Face and Jaw.
III. Wounds of the Neck.
IV. Injuries to the Spine and Spinal Cord.
V. Injuries to the Peripheral Nerves.
VI. Injuries to the Blood Vessels.
VII. Injuries to the Vessels of the Trunk and Neck.
VIII. Injuries to the Vessels of the Extremities.
IX. Gunshot Wounds of the Joints.
X. Fractures of the Upper Extremity.
XI. Fractures of the Lower Extremity.
XII. Organization for Orthopedic Treatment of War Injuries.
XIII. Orthopedic Treatment of Muscles, Joints and Bones.
XIV. Amputations and Artificial Limbs.
XV. Injuries and Affections of the Eye.
XVI. Injuries to the Ear.

In many of the chapters a preliminary discussion is made of the status of war surgery prior to the onset of the World War and of the surgical opinions prevailing at that time. With such a beginning it is possible to show plausibly the development of surgical procedures during the war and the final conclusions which were reached, noting the advance in surgical results from time to time.

In the chapter devoted to gunshot wounds of the head, several groups for the classification of wounds are mentioned, but preference is given to that proposed by Harvey Gushing, which was adopted in the A. E. F. Importance is laid on the proper examination and diagnosis of wounds which are apparently superficial (scalp wounds), as there may be accompanying cerebral injury or fracture of the skull. The final conclusions reached relative to the treatment of the gunshot wounds of the head were to the effect "that it was necessary to have a surgeon and a neurologist skilled in surgery of the head, to keep the patients for at least three weeks before transferring them to another hospital, and to maintain an adequate nursing staff. Operations were to be performed as soon as these conditions were fulfilled. The most favorable time at which to operate is as soon as the patient has overcome the primary wound shock and the shock of transport from the line. Not more than twelve hours should be allowed to elapse between the time of wounding and the time of operation."

As is well known, no branch of surgery made more advances than the operative procedures dealing with wounds of the face and jaw. In the chapter devoted to wounds of this region the author states that, before the war, surgeons had comparatively little experience with jaw and face injuries. The number of such injuries that occurred during the

World War was great, as trench fighting was much more productive of facial injuries than open warfare. Pieces of shell and other fragments were the causative agents of most of these injuries. This chapter contains a number of illustrations showing the splints and other appliances used, as well as some photographs depicting the excellent results of the surgical procedures in individual cases.

Peripheral nerve injuries were of great importance, as in a large proportion of wounds of the extremities there was an involvement of the main nerve trunk. During the early months of the war there was a great confusion of ideas to the proper line of treatment and the results to be expected in wounds of this type. However, patients with peripheral nerve wounds were collected in special hospitals, where a thorough investigation of the treatment of such lesions was made and many valuable lessons learned which warranted the laying down of well-defined rules of treatment. Primary suture of divided nerves was regarded as the ideal treatment, but under war conditions this was generally impracticable. It was therefore necessary to perform a secondary suture in the special hospitals referred to above. The results, on the whole, were very satisfactory.

Considerable space is given to the consideration of injuries to blood vessels—more, in fact, than the importance of the subject would seem to warrant. General Makins, the author of these chapters, has written a most comprehensive account of the war surgery of blood vessels and one which must take rank among the foremost contributions to that subject. The value of blood transfusion to replace blood lost by hemorrhage is referred to, and credit for the introduction of transfusion as a routine procedure is given to surgeons from Canada and the United States who had become interested through the work of Carrel and Crile.

Four phases are distinguished in the development of the methods for treating wounds of joints. In the early stages of the war attention was concentrated on drainage to the exclusion of all other methods of treatment. In phase two the treatment was briefly: (1) adequate immobilization on a suitable splint with extension if possible; (2) excision of infected parts; (3) lavage of the joint cavity; (4) closure of the capsule of the joint. In the third phase, the use of the Carrel-Dakin method of treating joint wounds was adopted. Phase four was characterized by the free and early excision of the injured area. The devitalized tissue was excised "en masse" down to and including the synovial membrane, and any foreign bodies were removed. The joint cavity was then cleansed and the synovial membrane and the capsule of the joint were sutured with catgut so as to close the joint cavity completely. If complete closure was impossible, the wound was packed with gauze soaked in liquid paraffine. Adequate immobilization, with extension if possible, was then provided. These principles applied to wounds treated within twenty-four hours. In cases not treated until later the Carrel-Dakin method after excision of the wound gave the best results. Early mobilization of injured joints, as soon as the wounds were healed, was insisted upon.

In the chapters devoted to battle fractures by far the greater amount of space is devoted to fractures of the femur, and stress is laid on the marked advances made in the treatment of this injury. Gunshot wounds involving fracture of the femur were among the most fatal injuries met with, especially when the causative agent was a shell fragment. "The man with a fractured femur was the subject almost more than any other of shock, gas gangrene and secondary hemorrhage." The advances made in the treatment of these conditions naturally resulted in improving the chances of the patients. The statement is made that "the chances in 1918 as compared with those in 1914 of survival with a useful limb of a man with a gunshot wound of the thigh with fracture of the femur, constitute a striking tribute to the success of military surgery." The Thomas knee splint, with some modifications in the method of use, was regarded as the best means of fixation.

The large number of injuries of joints, bones and muscles, with the resultant deformities and loss of function of parts which occurred during the early stages of the war, made it necessary that special hospitals for the care of such cases be organized. These hospitals were placed under the charge of the orthopedic service of the Medical Department. Surgeons with especial training in the care of this type of cases were assigned to duty at these hospitals to direct the treatment and to perform the necessary operations. Aside from the actual surgical intervention, it was found that other measures were necessary for the rehabilitation of these patients. These measures were instituted in special departments of the hospitals as follows: (1) massage; (2) electro-therapy; (3) psychotherapy; (4) gymnastic training; (5) balneological department, and (6) curative work shops. Tendon transplantation was done in cases where portions of muscles and tendons had been lost or where paralysis followed irreparable injury to a peripheral nerve. Owing to the large number of gunshot fractures with considerable loss of bony substance, frequently the result of infection, a large field for bone graft operations was presented. Especial emphasis is laid on the necessity of waiting for a long period of time to allow for the disappearance of any latent sepsis before attempting reconstruction operations.

Marked advances were made during the war in the methods of performing amputations and of fitting artificial limbs. The operative procedures were so designed that the stump might be best suited to comfortably accommodate an artificial limb of the proper type.

Separate chapters are devoted to injuries and diseases of the eyes and ears. The large number of men with defective vision which it was necessary to accept for the military service necessitated the development of an extensive service for supplying spectacles to those requiring glasses. A large spectacle depot was established, and thence extensive stocks of lenses and frames were supplied to the various ophthalmic centers so that practically any degree of defective vision could be promptly corrected. Special mention is made of the extensive use of magnets in the removal of intraocular foreign bodies and of the treatment of the eye injuries resulting from exposure to warfare gases, especially mustard gas.

It is stated that the proportion of injuries of the ear was much higher in comparison with other injuries than in any previous war. This was especially due to the use of much more powerful explosives than had hitherto been employed. Vertigo was frequently observed in wounds of the head, a disturbance of the labyrinth apparently being possible in wounds of any part of the skull.

The high standard of excellence set by the volumes of the British Medical History previously published has been well maintained in this volume.

THE MILITARY SURGEON

VOL. LII MAY, 1923 NUMBER 5

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

DYSENTERY, WITH REFERENCE PARTICULARLY TO THE LABORATORY DIAGNOSIS, EPIDEMIOLOGY AND TREATMENT

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INTRODUCTION

THERE are probably few disorders falling under the category of tropical diseases that have been more widely written on, and that are perhaps so little understood by the man who has not worked in the tropics, as dysentery. The dysenteries rank well with malaria in their importance in the daily practice of medicine in the tropics, and dysentery is the most frequently occurring serious acute disease in Manila and vicinity. Moreover, it is the most important so-called tropical disease that occurs in temperate climates. There probably are few medical men in the United States who realize how prevalent dysentery—particularly bacillary dysentery—is in their own country, or who realize that the lessons that I shall try to draw in the following pages for the benefit of the men working in the tropics apply with equal force to them.

The general run of physicians who have seen comparatively few cases of dysentery know that it is not a disease, but, instead, is a symptom-complex that may arise as a result of the activities of a variety of etiologic agents. Many men, however, fail to realize the full meaning of the definition as they fail to realize the perplexities that may arise as a result of the varied etiology of the condition. There often is a seeming lack of appreciation of the vital necessity of the correct differential diagnosis, and a bland unconsciousness of the consequences of error in this respect. The Day of Judgment will see the marshalling of a mighty phalanx of those who succumbed to bacillary dysentery because they were so unfortunate as to harbor, at the same time, one

of the non-pathogenic amoebae and were treated with emetine by the conservative physician whose slogan was: "An amoebae is an amoebae to me, and when I see one I give the patient emetine."

Another battalion will be made up of those whose endothelial macrophages were mistaken for amoebae by the incompetent microscopist, and who in consequence did not receive the serum that might have saved their lives.

In other words, a regrettably large number of persons the world over who are suffering from dysentery are being incorrectly treated as a result of incorrect clinical or microscopical diagnosis or both. It is still more regrettable that a considerable number of these people die as a result of this.

Two fundamental factors underlie this—a too conventional idea of the differential clinical symptomatology of dysentery on the part of the clinical man, and lack of knowledge on the part of the laboratory man on whom falls the burden of establishing the diagnosis on which treatment must be based, and upon which, to a large degree, the prognosis hangs.

There is nothing new in this. These principles have been enunciated countless times by experienced workers, but it is a regrettable fact that the tropical medical literature seems not to be widely read in the United States; at least it is not so widely read as it should be. This is the inevitable result of the artificial separation that exists between so-called "tropical medicine" and medicine of the temperate climates. Where this distinction may have been valid as a result of the imperfect extension of knowledge twenty or thirty years ago, it is less so today when we are learning of the cosmopolitan distribution of diseases that formerly were looked upon as limited to the tropics. It has become evident, now, that the diseases that were once regarded as falling solely within the purview of the tropical practitioner are now the business of every man who is concerned with the treatment of the sick. One only has to recall that *Leishmania tropica*, the cause of Oriental sore, was not discovered and identified in the East, where its ravages are most apparent, but in Boston. It also must be recalled that the first precise work on the etiology and pathology of amoebic dysentery was done in Baltimore by Councilman and Lafleur, who appear to have had little trouble in securing material on which to base their classical monograph in which they define amoebic dysentery as a clinical entity.

The remarks that follow are based on the experience gained by three years' contact with the clinical and laboratory problems arising in the differential diagnosis of the dysenteries, and in the contemplation of

the fallacies that have arisen and the errors that have been committed therein. It has also been my privilege to inquire into so-called "epidemic amoebic dysentery" on one or two occasions, and I have failed to reach any conclusion that would tend to vitiate the generally held view that amoebic dysentery does not become epidemic. In every instance where an epidemic of amoebic dysentery was believed to exist, it was shown to be the product of the combination of incorrect diagnoses and bacillary dysentery of a mild type.

However, these facts are mitigated to a considerable degree when it is appreciated that the mistakes that were made occurred very largely through the unavoidable military necessity that places men in situations that in civil life usually are dealt with by men who not only have had special training, but who have had the opportunity to reinforce that with extended experience, without which the original training loses much of its effectiveness. Moreover, they were mistakes that have been made many times all over the world and still are being made—mistakes, though, that may be costly in human life and from a monetary viewpoint. Similar mistakes were made by the British army medical officers during the late war, as will be mentioned later. They are, for the most part, mistakes born of lack of training and experience—misinterpretations that arise in the minds of those whose opportunities have not permitted avoidance of them. I have had the privilege of making these mistakes myself, and this article is prompted by the desire to share the benefit derived therefrom and to bring them sharply to the forefront to serve as lessons to those who in the future may have to cope with similar problems and face the possibility of similar errors.

As already stated, there is little doubt but that bacillary dysentery is more common in the States than is generally recognized, and numbers of cases are incorrectly diagnosed and consequently mistreated. While written largely from the viewpoint of the military service, the lessons can be of value to the lay practitioner in the States, who, seeing only sporadic cases of dysentery, especially bacillary, may fail to recognize them. A subsidiary function of this paper, therefore, is to stimulate an alertness in the general practitioner to the possibility of this condition in his routine work.

By way of presenting the situation in the form in which it is likely to occur at any post in the tropics or subtropics, I am using as a text the investigation of what was believed to have been an "epidemic" of amoebic dysentery arising on one of the posts in the Philippine Islands. This is not to be an exhaustive presentation of the subject of dysentery, but a more or less disjointed discussion of those phases of

the problem that are pertinent to the special lessons to be drawn from this investigation.

At this particular post there was a constantly high incidence of gastrointestinal disorders of various types, including an incidence of dysentery that fluctuated between ten to fifty cases per month and showing a distinct seasonal variation. All these cases were treated under a diagnosis of amoebic dysentery, and the curve finally rose until the peak was reached with about 150 cases in a single month, and an investigation into the matter became imperative.

All this, together with considerable collateral experience with the dysenteries, furnishes the basis for what follows, by which I shall try to show, on the basis of actual data, how the conditions may lead to anomalous and fallacious conclusions and by which it ultimately becomes possible to reverse the opinions held regarding the etiology of such an outbreak and to illustrate to a certain extent the methods to be pursued in making such an investigation.

In this particular investigation I had the advantage of the cooperation of Prof. Frank G. Haughwout, protozoologist at the Bureau of Science, Manila, and I wish to make acknowledgment at this time of the great value of his extended experience, recognized ability and indefatigable interest in accomplishing the task.

The following possibilities present themselves at the beginning of such an undertaking:

1. The existence of an epidemic of amoebic dysentery.
2. The existence of an epidemic of mild bacillary dysentery.
3. The occurrence of an outbreak of dysentery in which the two types are mixed.
4. The possibility of a series of incorrect diagnoses in ward, laboratory, or both.

In all probability the first stages of the investigation will demonstrate that the "epidemic" of dysentery is not amoebic in origin. However, it will be evident that a certain proportion of cases treated under a diagnosis of amoebic dysentery actually were dysentery of some type. It thereupon will become necessary to determine the type or types and the mode of dissemination of the infection. The work, therefore, may be conducted along somewhat the following lines:

1. A summary of intestinal disorders extending back to the time when the dysentery incidence showed a tendency to rise.
2. The study of case histories extending over a comparatively recent period.
3. The study of cases of dysentery developing during the course of the investigation.

4. The intensive microscopical, bacteriological, seriological and clinical study of at least 100 patients treated under a diagnosis of amoebic dysentery during a period of two or three months just prior to the investigation.

5. A study of the food-handlers in the various organizations, this to include parasitological and bacteriological study of the feces.

6. A survey and bacteriological study of the water supply.

7. A sanitary survey of the post in so far as the problem is concerned.

8. An inquiry into the possibilities as regards the dissemination of dysentery by foodstuffs, particularly green vegetables and dissemination by arthropod vectors.

9. An inquiry into the clinical and laboratory methods.

A program of this kind will be found to form a good basis for the study of such a problem. It should not be too slavishly followed, however, for individual undertakings such as this will be found to include peculiar factors that may be of great significance and upon which due stress must be placed.

It is one thing to deal with an epidemic at its height, at which time material available for the determination of its nature and source is abundant and often easily handled, and quite another thing to determine the nature and source of a condition that may arise from a number of causes, after the outbreak has declined.

An attack on the problem must be conducted on exceedingly broad lines. This will carry the investigator into the field of clinical medicine, where he must inquire into the nature of all gastrointestinal disorders that have been reported during a definite period. He must give detailed consideration, among other things, to the personal equation arising in the diagnosis and classification of rather closely allied conditions as interpreted by men holding varying points of view. He also must cope with the varying degrees of accuracy and thoroughness with which these several men have recorded their findings and interpretations. This is no light task, and it carries heavy responsibilities to the investigator. Let me illustrate this by quoting in abstract five actual case histories bearing different diagnoses, selected from among several hundred such cases studied by me.

Case A: Admitted with diarrhea, cramps, blood in stool.
Final diagnosis: Dysentery, entamoebic.
In hospital 10 days.
Temperature: Maximum of 100.
Treatment: Emetine.
Laboratory findings: 18,000 leucocytes. Feces on admission, *Entamoeba histolytica* vegetative and cysts; many red blood corpuscles and white cells. Negative on fifth day.

Case B: Final diagnosis: Dysentery, bacillary, acute, Flexner type.

The history states diarrhea began 3 days before admission and grew worse. He also suffered pain in the cardiac region, bloody diarrhea, headache, sweating, abdominal pain, anorexia, nausea and chilliness.

The stool on the day following admission was bloody and contained thick mucus, with numerous erythrocytes and leucocytes. The blood serum showed slight agglutination of a Flexner strain of *B. dysenteriae*.

Temperature was 100 on day of admission and thereafter normal.

He received 20 c.c. of antidysenteric serum on admission.

Case C: Male, aged 1 year.

Final diagnosis: Acute colitis catarrhal.

There was fever, diarrhea and the passage of bloody stool. General condition was good, however.

The laboratory the day following admission reported a thick mucofeculent stool containing blood and pus cells. No parasites and culture negative.

The temperature ranged from 103.4 on admission to 104 the next day, fell to normal on the fourth day to range from 100 to 102 on the sixth, seventh and eighth days.

Case D: Final diagnosis: enteritis, acute catarrhal, cause undetermined.

History of amoebic dysentery in 1920. Onset 11 days before admission with cramps and frequent bowel movements. General abdominal pains and tenderness and slight fever.

Several leucocyte counts were made, and these ranged from 10,600 to 15,800.

Laboratory: Bloody stool with thick mucus and pus. No parasites and cultures negative.

Temperature: 101.6 first day, normal thereafter.

Case E: Final diagnosis; diarrhea, cause unknown.

History of amoebic dysentery in 1920. Onset 5 days before admission with pain in abdomen, diarrhea, tenesmus, blood and mucus in stools. General abdominal tenderness.

Laboratory: Thick, mucoid, bloody stool containing pus. No parasites.

No rise in temperature.

The salient features of these cases are readily reduced to a table which makes their essential identity apparent (Table 1).

It will be seen that the gross clinical picture was strikingly similar in each case. Each was passing bloody stools, four of five showed elevation of temperature on admission, while the fifth, who was admitted on the fifth day after onset, probably had fever in the beginning. Total leucocyte counts made on two of them gave evidence of a leucocytosis. In the laboratory the stool of each was shown to contain pus. Notwithstanding this apparently clear picture of bacillary dysentery, a different diagnosis was made and different treatment carried out in each case. In only one instance (Case B) does the diagnosis appear to have been correct.

TABLE 1.—*Variation in Diagnosis and Treatment of Similar Symptoms*

Case	Final diagnosis	Clinical findings	Gross stool	Temp.	Total leucocytes	Laboratory findings	Treatment
A....	Dysentery, entamoebic.	Diarrhea, cramps..........	Bloody...	100	18,000	E. histolytica, veg. and cysts. Erythrocytes and pus.	Emetine.
B....	Dysentery, bacillary, acute.	Diarrhea, headache, sweats, nausea, chilliness; abdominal pain, cardiac pain.	Bloody...	100	Not done.	Blood, thick mucoid stool containing erythrocytes and leucocytes (pus).	Antidysenteric serum and bismuth.
C....	Acute colitis, catarrhal.	Fever, diarrhea	Bloody...	100 103.4	Not done.	Thick, muco-feculent stool, containing blood and pus. No parasites. Culture negative.	Salol and bismuth
D....	Enteritis, acute catarrhal.	Cramps, frequent stools, fever, general abdominal pain and tenderness.	Bloody...	101.6	15,800	Bloody, mucoid stool containing pus. No parasites, culture negative.	Morphine and salol.
E....	Diarrhea, cause unknown.	Abdominal pain and tenderness. Diarrhea and tenesmus.	Bloody mucoid.	No rise.	Not done.	Thick mucoid, bloody stool, containing pus. No parasites.	Not stated.

It is pleasant to record that all these patients recovered, but that is probably due, in no small measure, to the fact that at the place where these cases were treated the bacillary dysenteries were of a mild Flexner type, the more malignant Shigas being unknown.

When one encounters such evidence as this at the beginning of an inquiry into an "epidemic" of amoebic dysentery, harassing doubts beset the investigator. These are not relieved when he encounters numerous case histories reading as follows:

Case A: Admitted with loss of appetite. He had a cold. No diarrhea, no abdominal symptoms. Chills, fever and pains in lumbar region.

Final diagnosis: Dysentery, entamoebic, histolytica.

Temperature, 101.8° on admission.

Stools: 0, 1, 0, 2, 1. . . .

Treatment: Quinine enemas and emetine for 12 days.

Laboratory findings: 1st examination negative. Urine showed albumin, casts and erythrocytes; these persisted. 2d stool examination *E. histolytica* and Trichomonas. Negative on sixth day.

Case B: Admitted with slight fever and chill. No other symptoms, but laboratory reports stool positive for *E. histolytica.*

Final diagnosis: Dysentery, entamoebic, histolytica.

In hospital 7 days.

No rise in temperature.

Stools: 0, 3, 1, 4. . . .

No record of treatment.

Laboratory findings: *E. histolytica* 2 days after admission. Next report, and thereafter negative.

Case C: Admission with history of cramps a week previously. No diarrhea. Patient is constipated. Now has cramps and slight fever.

Final diagnosis: Dysentery, entamoebic, histolytica.

In hospital 15 days.

Temperature 104° on admission: normal next day.

Stools: 0, 2, 0, 2. . . .

No record of dysentery treatment.

Laboratory findings: *E. histolytica.* Negative next day.

Case D: Admitted with fever and chills, no abdominal symptoms, but laboratory reports positive for *E. histolytica.*

Final diagnosis: Dysentery, entamoebic, histolytica. "Symptoms of entamoebic dysentery relieved."

In hospital 13 days.

Temperature, 102.4° on admission. Thereafter normal.

Stools: 5, 3, 3, 4, 1. . . .

Treatment: No record of dysentery treatment.

Laboratory findings: *E. histolytica.* Negative on 2d examination and thereafter.

Thereupon the harassing doubts yield to a strong feeling, amounting almost to conviction, that a considerable number of men had been

admitted and treated for amoebic dysentery on the basis of incorrect laboratory diagnosis and insufficient clinical evidence to warrant the course that was followed.

This naturally leads, at the outset, to an inspection of the methods of diagnosis practiced in the hospital laboratory. In a number of instances it will be found that the greater portion of the work of microscopic diagnosis has been delegated to a corps man, who will be found to have no training in the proper sense for such work. The only thing approaching training received by many of these men has been the irregular direction that from time to time has been given them by their superiors. These men, as a rule, have no knowledge of pathology, histology or parasitology. Many of them will show total inability to distinguish between amoebae and tissue cells, or to differentiate between the various species of human intestinal amoebae, flagellates and the like. They have no knowledge of the differential characteristics of the stools of the various types of dysentery, particularly as to the identity and interpretation of the various cells encountered. Few of them have any clear idea as to the appearance of the various protozoan cysts and lack the knowledge on which to base the differential identification of the undeveloped cysts of the various species, a task that not infrequently taxes the knowledge and powers of interpretation of the most experienced protozoologists. In a word, such men are incapable of making reliable microscopic diagnosis of intestinal disorders of this character. As illustrative of the extent to which their ignorance can go, one corps man on whom the responsibility of this phase of the routine work of the laboratory rested frankly stated that his criteria for distinguishing between the motile forms of *Entamoeba histolytica* from *E. coli* were that if the amoeba contained red blood cells it was histolytica and if it contained leucocytes it was coli. There is no doubt but that with the proper amount of native intelligence enlisted men can be trained to do a certain amount of dependable laboratory work, but this particular phase, perhaps the most difficult of the routine laboratory procedures with the exception of histo-pathology, should not be left to their uncontrolled findings.

It has been my observation that the method employed in the laboratory diagnosis of these cases substantially is as follows:

1. The stools are collected in the wards and sent to the laboratory in paper cups, no means being provided against drying of the specimens.

2. In the laboratory these specimens stand around for variable periods of time, at the end of which a corps man makes cover-glass preparations from each specimen.

3. The slides thus prepared are laid on the table after having been

marked for identification. They rest not infrequently in the glaring sunlight, many of them for a matter of an hour or more, before they are examined.

No reliable results can be expected from such material in the diagnosis of acute amoebic dysentery. All of these slides should be prepared from the stool by the microscopist *at the time it is intended to examine them.*

FUNDAMENTAL ASPECTS OF THE PROBLEM

In dealing with a problem such as this, it is well to reflect upon the biological principles that govern the life history and general activities of the organisms involved. The problem may conveniently be attacked on the assumption that the outbreak was amoebic in nature, but it naturally will be undertaken with a degree of skepticism in view of the rather well-established principle that amoebic dysentery never occurs in epidemic form. Review of the aforementioned fact will add force to this belief and recall the disastrous experiences of the British Army in Gallipoli and Mesopotamia where incorrect laboratory observations, after the subsidence of the acute symptoms, led to the belief that amoebic rather than bacillary dysentery was the prevailing type of dysentery in these two places, whereas later investigation proved the opposite to be the case.

Moreover, the proportion between the incidence of infections with *Entamoeba histolytica* and the morbidity from amoebic dysentery in a community must be borne in mind. The proportion of persons infected with *E. histolytica* who develop amoebic dysentery is very low, probably in the neighborhood of 10 per cent. While a given group of people may show a high incidence of *E. histolytica* infection, the case incidence will always bear a low proportion to the number of infections when this is known. For an epidemic of amoebic dysentery to occur in such a group, granting on theoretical grounds that such a thing is possible, presupposes the development in a large number of individuals of that group, of the present unknown intrinsic factor that transforms a carrier of *E. histolytica* into a case of acute amoebic dysentery. Intercurrent bacillary dysenteries may easily lead to false deductions under such circumstances.

Insanitary conditions may lead to a *high incidence of infection* with *Entamoeba histolytica.* However, this will usually remain undiscovered over long periods of time, unless careful microscopic study is made of the faeces of every exposed person. The occasional development of scattering cases of amoebic dysentery distributed irregularly through the group will give little indication of the incidence of *E. histolytica* infection, and the morbidity usually will attract little attention unless all the cases are brought to one point for treatment.

In this respect infections with *Entamoeba histolytica* differ markedly from those with *Bacillus dysenteriae.* Infection with the latter organism usually is followed, within a few days, by an attack of dysentery of greater or less severity. There is, in the case of bacillary infections, no long latent phase which, in the case of *E. histolytica* infection, may extend over a period of months or years before dysentery supervenes. Infections may even persist through life without the development of symptoms of acute amoebic dysentery.

Given a common source of infection with *Entamoeba histolytica* a large number of infections may take place, but the resulting dysenteries will be small in number and will develop individually over long and irregular periods of time.

Given a common source of infection with *Bacillus dysenteriae,* nearly all, if not all, the infected persons will develop acute dysentery at about the same time and the outbreak will cease coincidentally with the removal of the source of infection.

It is generally recognized that a case of specific dysentery, whether amoebic or bacillary, will present at least the following symptoms: Abdominal pain, frequent bowel movements with blood and mucus in the stools. At the onset, or in exceedingly mild cases, blood and mucus may not be apparent except by careful inspection, and they may be overlooked. They may in the vast majority of instances be expected to be found at the closer examination given in the laboratory. While fever is usual in dysentery of the bacillary type, its absence does not by any means militate against a diagnosis of bacillary dysentery. It may be entirely absent or it may be so slight or transitory in the mild Flexner type as to be unnoticed. On the other hand, fever is seldom a feature of uncomplicated amoebic dysentery.

The differential diagnosis of the dysenteries from the clinical viewpoint, therefore, enters into the consideration of the problem as a whole. In general, it may be said that physicians, whose experience with dysentery has been limited to the classroom or the observation of a small number of cases under inadequate laboratory control, form certain conventional views regarding the clinical phenomena exhibited by the various types of the process. This leads them to interpret the syndrome on the basis of the physical reaction of the patient.

It may be said at this time that it is a matter of agreement, among those competent to speak with authority on the subject, that it is practically impossible, and certainly unsafe, to make a differential diagnosis between bacillary and amoebic dysentery on clinical grounds alone. It is on the laboratory examination that the differentiation must finally rest.

However, as has been said, this is not always apparent to the clinical man unless he has had a more or less extended experience with dysentery. Therefore, one frequently encounters clinical men who differentiate the dysenteries much as follows:

Amoebic dysentery: That type of dysentery in which there is no elevation of temperature, no evidence of toxemia and no symptoms of collapse. Dysentery of a chronic nature, prone to relapse.

Bacillary dysentery: Acute in onset, accompanied by marked elevation of temperature, and symptoms of toxemia and collapse frequently terminating in death.

The prevailing view among such men is that, on clinical grounds, dysenteric patients tend to clearly fall into one or the other classification. That is to say, if the patient is passing dysenteric stools, but has no pyrexia and shows no evidence of toxemia or collapse, a diagnosis of amoebic dysentery is justified on clinical grounds alone. Such a diagnosis is easily confirmed by an incompetent microscopist.

While this clinical classification is roughly true, experience in the Philippine Islands and other places shows that these are not safe criteria upon which to base a diagnosis, and therein lies a partial explanation of the mistakes that so frequently occur.

Bacillary dysentery is known to be the prevailing type of dysentery in Manila and the vicinity, and the same is probably the case elsewhere in the Philippine Islands. Individual cases of intestinal and hepatic amoebiasis apply for treatment in institutions and to physicians, much as do those affected with the general run of diseases, and they take their place in the morbidity records but do not contribute largely to the mortality in the community.

Bacillary dysentery shows a seasonal incidence in Manila, the curve of incidence reaching its highest point during the period of the heavy rains. The records of the Philippine Health Service and the various hospitals contain comparatively little data regarding the variety of organisms involved in these bacillary dysenteries, but careful clinical and microscopical observations, checked by bacteriological studies at the Department Laboratory and the Bureau of Science, as well as publications of those who have conducted specific research, furnish data that warrant the belief that the greater number of the bacillary dysenteries are caused by infection with the Flexner strain of *Bacillus dysenteriae* which, it will be recalled, was originally identified in Manila.

The clinical picture presented by patients infected with the Flexner strain of *Bacillus dysenteriae* is more or less characteristic. In the greater number of instances the symptoms are relatively mild, as contrasted with those observed in Shiga infections. The temperature

seldom rises above 102° F. and often it is scarcely above 99° or 100° F. There may be considerable abdominal discomfort for a while with frequent bowel movements of dysenteric character, but there is no toxemia and little prostration or collapse. The patient may have cramps of moderate severity and may pass stools containing blood and mucus, but the symptoms may have practically subsided before he comes under treatment, or after a single dose of 20 c.c. of antidysenteric serum. Prompt serum treatment is followed within twenty-four to thirty-six hours by a complete abatement of all symptoms. If the serum treatment is not continued, there may be a mild recrudescence on the fourth or fifth day, but convalescence usually is rapid and uneventful. However, in many instances when the infection is of a more virulent type, the patient is left with a chronic ulcerative condition of the colon, which may lead to chronic invalidism. This point will be mentioned again in relation to treatment.

The above outlines the situation in adults. Children, as a rule, react much more intensely to even the Flexner type of infection, and the mortality rate is high among them. The less frequently occurring infection with the Shiga strain of *B. dysentery* usually runs a more severe, frequently a fulminating course, and contributes the greater number of deaths due to bacillary dysentery.

If, through mistaken diagnosis, the mild cases are treated with emetine, they will in many cases do well notwithstanding the lack of specific treatment, thereby leading to the erroneous impression that the etiology of the condition has been established by a therapeutic test. Yet it is frequently found, in a large number of cases, that the total amount of emetine administered was much under that which experience has shown is necessary to sterilize a patient of an *Entamoeba histolytica* infection.

Bacillary dysenteries of this type, particularly those in which the temperature shows no substantial rise, bear a very close resemblance, clinically, to amoebic dysentery. The burden of establishing the final diagnosis, therefore, rests upon the microscopist. If he be well trained and experienced—and I lay emphasis on experience—the task offers no serious difficulty and the proportion of incorrect diagnoses will be small. If, on the contrary, the task is imposed upon a man with a smattering knowledge of parasitology, and no knowledge of histology and pathology, the probability that he will err becomes great. To the untrained eye and in the mind of the man incapable of appraising the picture as a whole, a large endothelial cell, particularly if it contains erythrocytes, immediately becomes an amoeba, and the fact that the field is littered with necrotic epithelium and leucocytes carries no sig-

nificance and conveys no suspicion that the process is bacillary rather than amoebic.

Moreover, human feces contain a large variety of bodies that may be mistaken for cysts of protozoa and tissue cells. The organism, *Blastocystis*, frequently is mistaken for the cysts of amoebae, and the other objects may readily be mistaken for erythrocytes by the unskilled as I once had occasion to witness in a very striking instance in which the laboratory technician had diagnosed, as erythrocytes, bodies that turned out to be *Blastocystis*, the hyalin vacuoles of which had taken up some red coloration from the feces. A broad knowledge of the appearance of protozoa and tissue cells in a state of degeneration as well as in the normal is essential to accurate work of this kind. Lack of this knowledge on the part of those delegated to perform this work in the laboratory furnishes the explanation of many of the bizarre and inconsistent entries on the laboratory reports that one runs across in the course of such an investigation; for example, the extraordinary statement of the finding of "detritis of cysts of *Entamoebae histolytica*."

Accumulated knowledge bearing on the microscopic picture presented by the dysenteries now makes it relatively easy to make a differential diagnosis without resort to bacteriological methods; indeed, a negative culture may be very misleading. This picture bears a close relation to the pathology of the type of dysentery involved. The cellular exudate of bacillary dysentery bears the stamp of a toxic necrosis. The microscopic field is full of leucocytes and epithelial cells in various stages of necrosis and there likewise are, in addition, erythrocytes, numerous, large endothelial macrophages, some of which may have phagocytized red blood corpuscles. These cells always stand out prominently in the microscopic field, and not infrequently require to be carefully studied under high magnification before it can be certain that they are not amoebae, especially as they may undergo changes in outline that may readily be mistaken for ameboid movement. The differentiation can only be made by one familiar with the appearance of both under a wide range of conditions. Their presence, with an abundance of leucocytes of the polymorphonuclear type, coupled with the evidence of a toxic process, is diagnostic of bacillary dysentery. These things have been discussed in considerable detail by Lynch,[1] Wenyon and O'Connor,[2] Willmore and Shearman,[3] and others to whose papers the reader is referred.

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[1] Lynch, Kenneth M.: "Macrophages in Feces in Acute Dysentery." Jour. Lab. & Clin. Med. 2, 1917, 251.

[2] Wenyon, C. M., and O'Connor, F. W.: "Human Intestinal Protozoa in the Near East." London, 1917, John Bale Sons & Danielson, Ltd.

[3] Willmore, J. Graham, and Shearman, Cyril H.: "On the Differential Diagnosis of the Dysenteries." Lancet, 2, 1918, 200.

If motile *Entamoebae coli* or other amoebae are present, the picture is further complicated and it becomes necessary to determine the species, often by methods of staining.

The stool of uncomplicated amoebic dysentery is of strikingly different type. As in the case of bacillary dysentery, both blood and mucus are present, but where the cellular exudate of bacillary dysentery is rich, that of uncomplicated amoebic dysentery is very scant, the microscopic picture being made up largely of erythrocytes. Cells of the mononuclear type tend to predominate over the polymorphonuclear, which are relatively few in number. However, this cannot be depended upon as a basis of microscopical diagnosis. The only criterion here is the finding of amoebae and their absolute identification as *Entamoebae histolytica*. In a fresh stool of amoebic dysentery in the acute stage, actively moving amoebae, many of them containing erythrocytes, usually are abundant, and their identification on this basis is not a difficult matter for one with a little experience.

Finally must be considered the occurrence of Charcot-Leyden crystals in such stools. I mention them merely as a part of the evidence in such cases, for there is undoubtedly a close association between them and intestinal amoebiasis and possibly hookworm. At least one eminent British authority has attributed pathognomonic importance to them. While it probably is true that the association of Charcot-Leyden crystals with amoebiasis is very high, I am not yet prepared to accept the conclusions of the British worker *in toto*, and prefer to regard their presence as suggestive much as we regard a marked rise in large mononuclear leucocytes in cases where the microscopic diagnosis in malaria has not been confirmed by the finding of *Plasmodium*.

There are certain types of diarrheas that may represent mild exacerbations of either type of dysentery or which may be the product of non-specific ulcerative processes in the colon. Stools of this kind have been discussed by Haughwout[4] who has pointed out some of the misleading appearances they present and endeavored to explain their origin.

These stools often present great difficulties in interpretation to even the experienced worker. It often happens that they contain numerous trophozoites and precystic and encysted forms of the various species of amoebae that are found in the intestine of man. These cases may be simple diarrhea, or a chronic ulcerative process, or they may represent the early or late stage of an acute specific process—*either bacillary or amoebic.* In any event, they require careful and often

[4] Haughwout, Frank G.: "Observations on the Differential Diagnosis of the Dysenteries." Journ. P. I. Med. Assn., 1, 1921, 53.

prolonged study. The accurate identification of the amoebae present becomes a matter of prime importance to the patient and clinician. If *Entamoebae histolytica* is present, there is presumptive evidence that the condition is really amoebic dysentery, which may or may not be borne out by subsequent events. If, on the other hand, *E. coli*, *Endolimax nana*, *Iodamoeba bütschilii* or *Dientamoeba fragilis* are found, as the case may be, after repeated and careful search, it obviously is irrational to place the patient on emetine.

The identification of these amoebae represents a study in comparative morphology. It obviously can be successfully undertaken only by one properly trained who has learned to know the structure of these organisms. The identification very frequently cannot be made until fresh living specimens are fixed and stained by precise cytological methods and careful study under high powers of magnification.

It may be objected that cytological methods require a certain degree of skill and consume time. In admitting this, I will remark, in passing, that the same objection may be held to apply to the Wassermann reaction, the recent methods of nitrogen determination, and bacteriological work in general. I consider that familiarity with the simpler cytological methods, which are quite sufficient, should be as much a part of the equipment of the laboratory man as the ability to run and correctly interpret the Wassermann reaction.

In view of the frequent lack of application of the essential methods in the identification of intestinal protozoa, it is highly probable that a considerable number of the determinations of cysts of *Entamoebae histolytica* and *E. coli* made in the general run of laboratories are incorrect, especially as partially developed cysts of both species are of very frequent occurrence in the course of routine laboratory work. It also must be pointed out that in bacillary dysentery, polymorphonuclear leucocytes are prone to undergo a type of karryorrhexis in which the chromatin breaks up into two or more annular bodies that are readily mistaken by the novice for nuclei of the type found in amoebae, and in consequence the leucocyte is identified as a cyst, usually as a cyst of *E. histolytica*.

Furthermore, it is strikingly significant that the only amoebae that appear to be noted in routine stool examinations as usually conducted are *E. histolytica* and *E. coli*. Infections with *Endolimax nana* and *Iodamoeba bütchilii* are often found by careful workers.

I have encountered records of cases the clinical histories of which presented no evidence whatever of dysentery of any type, also instances where men applied on sick call for treatment of other ailments including constipation, whose stools were in the routine sent to the laboratory.

A large number of these were reported positive for *Entamoeba histolytica* and red blood corpuscles, the men in consequence being subjected to a course of treatment with emetine and quinine anemas. Study of the laboratory reports on these cases show the motile forms to have been present, to have persisted for variable periods of time, to be succeeded by cysts, and finally the men to have been free from trophozoites and cysts for three successive examinations. I admit that *Entamoeba histolytica* infections in the acute stage frequently follow just this course, and for this and other reasons I hesitate to venture an explanation. I cannot refrain from remarking, however, that *E. histolytica* containing ingested erythrocytes appear in the stools only when some active ulcerative process is in progress somewhere along the course of the colon. Moreover, attention must again be called to the transient appearance of the cellular exudate of mild bacillary dysentery, the fairly high incidence of infection with *E. coli* and the frequent appearance of its cysts and the cysts of other intestinal protozoa. It must be borne in mind that the cysts of no species are constantly present in stools throughout an infection. Their appearance is intermittent and not governed by definitely determinable periodicity, so that the whole question resolves itself into the determination of the accuracy of the identifications that were originally made. Often that accuracy is open to serious question. For that reason it is invariably safe to consider that the highly regular conduct of these infections, as they appear on the records, constitute acceptable evidence that these are really not infections with *E. histolytica.*

It seems not to be too radical a statement to say that it would be better not to examine the stools of such cases than to record such a succession of findings as these. Those innocent of infection would be spared the rigors of the emetine treatment and the genuine cases naturally will be admitted on their clinical symptoms, and laboratory examinations follow in the normal course of events.

LABORATORY METHODS

These simply consist in the application on a somewhat larger scale of the methods that should be employed in the routine work in the laboratory. Stools must be collected from each individual under study and delivered to the microscopist as soon after passage as possible, and they should be examined with the least possible delay. It is well to plan the work so that only the number of specimens that can be properly studied during working hours are submitted in any one day.

As a general rule, it is better to secure a normally passed stool, but when it becomes necessary to resort to cathartics, a mild dose of cascara

sagrada is best. Saline cathartics produce a stool so watery that difficulty is experienced in making permanent preparations. Castor oil should never be used, for the droplets of oil are sometimes difficult to distinguish from cysts under the low powers of magnification employed in searching the slides. All stools that obviously are unfit for satisfactory study should be rejected and the men required to submit other specimens. Care must be exercised to prevent substitution of specimens.

Ideally, in the search for *Entamoeba histolytica* carriers, the feces of each subject should be examined five or six times. However, unless the services of several competent microscopists are available or unless it is possible to spend considerable time on the problem, it is hardly practicable to carry out such a program. In a dysentery survey, search for *E. histolytica* will naturally be prosecuted with special attention. It is well, however, to include hookworm. It is best to record every parasite found, such data often being suggestive, if not actually helpful, in connection with the problem as a whole. In any event, all negative cases should be reexamined repeatedly until they are positive for either *Entamoeba histolytica*, hookworm, or both, or until it seems unlikely that these will be found. In pursuance of this plan, many cases will be examined two, three or even four or five times before it finally is recorded as negative.

Two or more fresh cover glass preparations should be made from each stool and carefully inspected from end to end, the entire area of each preparation being covered. Formed feces will be emulsified in physiological sodium chloride solution. It should be possible to read newspaper print through the preparation. Iodine solution must constantly be employed in the identification of protozoa, especially cysts. Accuracy in results is considerably increased if two workers can check each other's findings. In doubtful cases such as those which sometimes arise when the nuclei of amoebae cysts are obscured by large glycogen vacuoles, it may be necessary to fix preparations and stain them by the haematoxylin method of Heidenhain. In this way it is usually possible to secure positive identification of practically every protozoan infection detected.

As a check on the direct method of examination, every stool should be subjected to concentration by the method of Cropper and Row.[5] This considerably augments the findings.

By this method, a small portion of the stool, 1 to 2 grammes, is shaken up in physiological sodium chloride solution until it is completely broken down and emulsified and the cysts of protozoa and ova of hel-

[5]Cropper, J. W., and Row, R. W. Harold: "A Method of Concentrating Entamoeba Cysts in Stools." Lancet, 1, 1917, 179.

minths are freed of adherent fecal matter. The emulsion is then shaken with a small quantity of ether and poured into a separatory funnel. The organic debris, which has absorbed the ether, rises to the surface and the cysts and ova fall. These are drawn off at the bottom and thrown down in the centrifuge. The entire sediment is examined under the microscope.

The flotation method of Kofoid and Barber may also be employed, but it is not so generally applicable as that of Cropper and Row. Protozoan infections will be missed, and there will be trouble in identifying cysts which become distorted in the hypertonic solution. The Kofoid and Barber[6] method is excellent for the detection of the general run of nematode and cestode infections, but it is untrustworthy in detecting infections with trematodes and protozoa. The procedure is as follows:

A considerable volume of the stool is placed into the bottom of a cylindrical container and thoroughly broken down and emulsified in saturated sodium chloride solution. A thin disc of steel wool about one-quarter of an inch thick is moulded to a diameter corresponding to the internal diameter of the container. This disc is then forced down to the bottom carrying down the coarse "float." After the lapse of ten or fifteen minutes to allow the cysts and ova to rise to the surface, they are skimmed off by means of a large wire loop and transferred to the slide for examination.

The Cropper and Row method consumes more time, is more complicated and expensive than the Kofoid and Barber method, so that for a simple hookworm survey the former is unsuitable, but it yields results with all helminthal ova and protozoan cysts. The method has recently been criticized by Dobbel and O'Connor, who doubt its superiority over the direct method in the detection of light infections. Much of what these writers say undoubtedly is true, especially as regards the destruction of cysts. It is true that the contents of protozoan cysts become shrunken and their identification rendered difficult. This happens mainly with amoebae cysts, but these always are recognizable as such, and the necessity for reexamination of the stool to determine the species is thereby indicated and many infections that otherwise would go undetected are picked up in this way. Many helminthal infections will be missed if specimens are not concentrated, so I have come to consider that, if properly performed, it yields results that are worth the effort.

In the study of an epidemic of dysentery it is necessary, of course, to conduct a search for carriers of *Bacillus dysenteriae*, primarily as evi-

[6] Kofoid, C. A., and Barber, Marshall A.: "Rapid Method for the Detection of Ova of Intestinal Parasites in Human Stools." Journ. Amer. Med. Assn., 71, 1918, 1557.

dence of the nature of the dysentery, whether bacillary or amoebic, and secondarily from an epidemiological standpoint to determine the source of the infection. If there is an opportunity to study acute cases, the first point can readily be established, but if the study is undertaken after the epidemic has passed, the bacteriological results are increasingly unsatisfactory with the passing of time.

The details of the cultural methods will not be given. It is simply necessary to emphasize the very important points that *freshly* passed stools only should be cultured; that in acute dysentery, the likelihood of isolating *B. dysenteriae* decreases rapidly with each day of the disease, and the percentage of carriers developed in bacillary dysentery is small, so that little help in the study of an epidemic can be expected from bacteriological studies made on post dysenterics.

The same might be said of serological studies. Experience would seem to show that not a great deal of dependence can be placed on immunological reactions as a diagnostic measure in bacillary dysentery, and personal experience confirms this. On the one hand, it frequently happens that even during the active stage of the infection, with recovery of *Bacillus dysenteriae* from the stool, agglutinins will be absent from the blood serum; on the other hand, sera of some individuals who have never had an infection will show an active agglutination of one more strains of the specific organism.

Such examination, however, may give suggestive information and should, therefore, be a feature in the study of an epidemic. The patient's serum should be tested with several strains of *Bacillus dysenteriae* in dilutions that will exclude false reactions—at least 1–40, and higher on those sera showing agglutination in this dilution—using by preference the macroscopic method. The sera of those who are ill at the time and a representative number of those who are convalescent or cured should be examined, together with a number of known negatives as control.

The following results were obtained in the study of one "epidemic" and will tend to indicate the degree of dependence that can be placed on this feature of such an investigation. No active cases were examined, but patients were selected at random from a number that were recorded as amoebic dysentery, without reference to the clinical history and its bearing on the probability that they had had bacillary dysentery. The examinations, as a rule, were made several months after the men had been discharged from the hospital. This, no doubt, considerably lessened the likelihood of obtaining positive reactions. Table 2 presents this data.

TABLE 2.—*Serum Reactions of 68 Post Dysenteric Subjects*

Clinical diagnosis	No. of men	Serum reactions		Per cent
		Positive	Negative	
Dysenterics	15	7	8	47
"Suspicious"	41	19	22	47
Undetermined	4	2	2	50
Non-dysenterics	8	2	6	25
Total	68	30	38	44

It will be seen that 44 per cent of the entire number of men gave positive agglutination with one or more of the three strains of *Bacillus dysenteriae* used. Excluding the eight cases that frankly were not dysentery, positive reactions were obtained in 48 per cent of the group. There are no records that will show as high a percentage of positive reactions as this from normal sera. Twenty-five per cent of the eight non-dysenteric cases we examined gave a positive reaction, but the series is too small to enter into argument with respect to this point. When it is realized that after the development of agglutinins in an infection with *Bacillus dysenteriae* they tend to decrease rapidly during convalescence, it becomes apparent that we might well have found a higher percentage of positives had we examined the men sooner after their attacks. Therefore, these findings are, at least, suggestive that a majority of these patients had suffered from *B. dysenteriae* infections.

DEFECTS IN DIAGNOSIS AND CASE HISTORIES AND THEIR CONSEQUENCES

Dysentery has been defined as a symptom-complex arising in the intestinal tract as a result of a variety of specific causes such as protozoa, bacteria or helminths. On the perusal of a considerable number of case histories that have been included in the records of so-called "epidemics" of amoebic dysentery, I have been led to the belief that in some instances "epidemic amoebic dysentery" can be defined as a state of mind arising from certain specific causes such as disordered laboratory methods and indecision.

By way of showing how important a part this state of mind can play in such conditions, I am presenting abstracts of twelve case histories selected from among those composing one of these so-called "epidemics." The periods of hospitalization of these cases ranged from one to fifty days, with an average of practically fifteen days. These cases were all treated under a diagnosis of amoebic dysentery,

and yet inspection of each abstract will fail to yield clinical evidence that will harmonize with the laboratory findings. I regard it as highly improbable that any of these men had acute amoebic dysentery. Let us take up these cases seriatim. Cases A and B may be considered together.

Case A: Admitted with pain in sacrum. Blood in stools for 3 years following jump from fast-moving train. Final diagnosis: (1) Dysentery, entamoebic, histolytica. (2) Hemorrhoids.

In hospital 50 days.

Temperature: No rise.

Stools: 2, 9, 4 . . . .

Treatment: Quinine enemas and emetine for 36 days.

Laboratory findings: *E. histolytica* and red blood cells. 5th day negative. 14th day positive. 20th day positive with blood. 30th day negative. 37th day cysts of *E. coli.*

Case B: Child of 8 years. Admitted with history of sickness for some time. Extreme pallor, kidney tenderness.

Final diagnosis: Dysentery, *E. histolytica.*

In hospital 25 days.

Temperature 102° for three days. Pulse 54–100.

Stools: 1, 1, 3. . . .

Treatment: Much quinine. Bismuth. Quinine enemas and emetine.

Laboratory findings: 1st examination negative. 3rd day *E. histolytica, E. coli* free blood. 8th day negative. Leucocytes, 4,000: erythrocytes, 2,960,000. Haemoglobin, 60 per cent. Polymorphonuclears, 75 per cent.

In case A it will be seen that the laboratory reported *Entamoeba histolytica* and "red blood cells" and ultimately cysts of *E. coli.* The clinical history shows no evidence of dysentery of any type, but it does show that the man suffered from hemorrhoids. It therefore is to be expected that the amoebae reported originally by the laboratory were the trophozoites of *E. coli*, the cysts of which were reported on the thirty-seventh day, while it is not improbable the "red blood cells" came from the hemorrhoids.

The clinical notes and stool record of case B bear no evidence of amoebic dysentery. On the contrary, the clinical record and blood findings indicate very strongly that something entirely different was the matter with this child during the twenty-six days treatment with quinine, bismuth and emetine.

Case C: Admitted with fever, general aches, headaches, constipation, rash. "Stools positive for *E. histolytica* but no symptoms."

Final diagnosis: (1) Dengue. (2) Dysentery, *E. histolytica.*

In hospital 16 days.

Temperature 103.4°.

Stools: 1, 1, 0. . . .

Laboratory findings: *E. histolytica* on 2nd day. *E. histolytica* cysts on 6th day. 9th day negative. 13th day negative. 14th day *E. coli.*

Case D: Admitted with cramps and constipation.

Final diagnosis: Dysentery, *E. histolytica.*

In hospital 23 days.

Temperature 101° for one day.

Stools: 1, 2, 1, 0. . . . .

Treatment: "Dysentery treatment; full diet."

Laboratory findings: *E. histolytica* on 1st and 8th days. Negative on 5th and 15th days.

Case E: Admitted with cramps, no diarrhea. No blood or mucus.

Final diagnosis: Dysentery, *E. histolytica.*

In hospital 22 days.

Temperature, 100°. Pulse, 100 maximum.

Treatment: Aspirin.

Laboratory findings: *E. histolytica*, red blood corpuscles once. Two negatives.

Cases C, D, and E are interesting because two of the men were frankly constipated and the other had no diarrhea. Such cases as these show what consequences follow slavish dependence on laboratory findings from an unreliable source and the failure to intelligently interpret such findings and the clinical picture. The diagnosis of dengue in case C would seem to be perfectly clear and the second diagnosis entirely superfluous.

Twenty-three days seem to have been consumed in the treatment of a dysentery in case D from which the patient in all probability never suffered, notwithstanding he appears to have been placed on full diet in the mess hall on the day of admission or soon after. Case E is similar, and practically the same comment applies.

Cases F, G and H really require no comment aside from the fact that their total hospitalization amount to nineteen days, during which time treatment was administered for an acute condition, the existence of which there is not the slightest evidence.

Case F: No complaint on admission. He came in for examination, was given salts and pronounced positive by laboratory for *E. histolytica.*

Final diagnosis: Dysentery, entamoebic, acute, *E. histolytica.*

In hospital 7 days.

No rise in temperature.

Stools: —, —, 0, 3. . . .

Treatment: Emetine.

Laboratory findings: *E. histolytica* and red blood corpuscles, 2 days before admission. The second day after admission he was negative.

Case G: On admission had not been sick (sent in for examination); given salts and stool sent to laboratory.

Final diagnosis: Dysentery, entamoebic, acute, *E. histolytica.*

In hospital 6 days.
No rise in temperature.
Stools: 2, —, 2, 2, 3. . . .
Treatment: Emetine.
Laboratory findings: 2 days before admission *E. histolytica* and red blood corpuscles. 2nd day negative.

Case H: Admitted in good condition. Hand dressed. No other history.
Final diagnosis: *E. histolytica.*
In hospital 6 days.
No rise in temperature.
Stools: 2, 8, 3. . .
Laboratory findings: *E. histolytica.* Only one examination.

Cases I and J, abstracted below, present even a sadder commentary on this form of hysteria. Neither of these men appears to have shown the slightest clinical indication of dysentery. In fact it would seem that J máde an earnest disclaimer.

Case I: Admitted with salvarsan reaction. Chills, fever and nausea. Stretcher case. Looks very sick. No abdominal symptoms.
Final diagnosis: (1) Reaction from salvarsan. (2) Dysentery, *E. histolytica,* acute.
In hospital 12 days. Mess hall 2nd day.
Temperature 102.2° for 1 day.
Treatment: "10 days treatment."
Laboratory findings: 2nd day *E. histolytica,* red blood corpuscles. 6th day negative.

Case J: On admission history of bed wetter all his life. "Claims to have absolutely no symptoms of dysentery."
Final diagnosis: (1) Enuresis, nocturnal. (2) Dysentery, entamoebic, acute, *E. histolytica.*
In hospital 1 day, after which he absconded.
No rise in temperature.
Stools: No record.
Treatment: None given.
Laboratory findings: *E. histolytica* motile. Trichomonas. One examination only.

Finally are presented two cases in which the clinical man was clearly at fault, the laboratory having reported *Entamoeba coli.*

Case K: History not obtained.
Final diagnosis: Dysentery, entamoebic, *A. coli* found. (This diagnosis was later changed to dengue.)
In hospital 9 days.
Temperature not given.
Stools: 4, 7, 2, 1. . . .
No treatment.
Laboratory findings: *E. coli.*

Case L: Admitted with 3 weeks' history of a cold, headache, pain in stomach and diarrhea.

Final diagnosis: "*E. coli* dysentery, mild, acute."
In hospital 2 days.
No rise in temperature.
Stools: 4.
Treatment: Quinine enemas and emetine.
Laboratory findings: *E. coli.*

It is evident that doubt arose in the mind of some one in case K, for the diagnosis was changed from "Dysentery, entamoebic, *A. coli* found," to "Dengue." The diagnosis "*E. coli* dysentery, mild, acute," that was made in case L, is an absurdity that requires no discussion.

Records such as these, of course, present very clear evidence in an investigation, and it is easy to relegate them to their proper place. Unfortunately, however, the task is not always so easy. The extraction of valid evidence from old case histories often is a difficult undertaking because of the incompleteness of laboratory and clinical records. Progress reports are apt for the most part to be either lacking or so vague in character as to offer no reliable basis for conclusion. Treatment is not thoroughly recorded in many cases, and the laboratory reports often will be found to contain no details as to the general macroscopical and microscopical characters of the stools. Frequently mere note will be made of the occurrence of *Entamoeba histolytica*, red blood cells and sometimes free blood. It often is not clear whether the red blood cells occurred free in the stool or whether they were red blood corpuscles that had been phagocytized by amoebae. This latter point is of considerable importance in diagnosis. In rare instances, note may be made of pus in stool, but seldom is mention made of necrotic epithelial or endothelial cells and Charcot-Leyden crystals either are not identified or not recorded. All these points, when properly recorded, tend to clear the diagnosis.

In a study of a group of about two hundred and fifty men who had been treated under a diagnosis of acute amoebic dysentery, it was necessary to throw out of consideration a large number of cases for reasons stated above. It was, however, possible to extract considerable interesting information from the others.

It was found, among other things, that no less than thirty-five patients had been admitted for treatment of conditions bearing no relation whatever to dysentery. The diagnosis of amoebic dysentery was made, supplementary to the original diagnosis, after a stool specimen had been sent to the laboratory and a report made of the findings of *Entamoeba histolytica.* In all, fifty-nine men are stated to have had amoebic dysentery on whose clinical record there was no evidence of intestinal symptoms of any nature.

From the laboratory reports it appears that diagnoses of acute

amoebic dysentery were made in sixteen cases on the discovery of encysted amoebae alone. In only four of these cases are trophozoites reported to have subsequently made their appearance in the feces. Aside from the question that naturally arises as to the correct identification of these cysts and trophozoites, the fallacy of basing a diagnosis of acute dysentery on the finding of cysts only, is quite apparent. It is true that cases showing cysts only—chronic cases—should receive antiamoebic treatment; but they should be classified as amoebiases rather than "dysentery, acute, entamoebic." There also would appear to be no more justification for retaining simple carrier cases in the hospital in the absence of other conditions that would necessitate it, than there is in the case of syphilitics after they have become non-infectious. A false factor is introduced into the non-effective rate and hospitalization greatly increased.

The laboratory reports on two hundred and seven cases note the presence of trophozoites only. No mention is made of the appearance of cysts at any stage in the progress of the cases. This, once more, raises the question as to the nature of the bodies identified as amoebae. The failure to report the development of cysts under treatment in such a large number of cases might be explained on the basis of several assumptions:

1. Failure to make or record observations.

2. Identification of animal or plant cells, other species of amoebae or other bodies as *Entamoeba histolytica*.

3. Insufficient treatment.

4. The detection of a large number of cases of infection with *Entamoeba coli* and their incorrect microscopical identification.

These assumptions will now be considered:

1. From the general character of the entries on these case histories, it is possible that many cases were not closely followed in the laboratory, and in consequence there is not a continued record that would show the behavior of the organisms identified as *Entamoeba histolytica*.

2. Comparison of the laboratory findings with the clinical data leads to the conclusion that some of these men suffered from bacillary dysentery, and that the endothelial macrophages were identified as *Entamoeba histolytica*, no significance having been placed upon the general microscopical characters of the stools. The presence of other species of amoeba, *Blastocystis* and the like, may have led to confusion here.

3. A large proportion of cases obviously received insufficient treatment. A certain proportion of these might be expected to show spontaneous subsidence of symptoms, but many of them would not have

done this, but, instead, would have undergone prolonged convalescence and become carriers. Some of them probably would have suffered clinical relapse.

4. *Entamoeba coli* was recorded twice only in this group of men, but the incidence of that species certainly must have been much higher than this. The size and general appearance of this amoeba makes it probable that the greater number of organisms correctly identified as amoebae were of that species. My own observations at this post showed *E. coli* to be present in the proportion of 10 to 26 per cent in the several racial and age groups surveyed.

It is an established fact that emetine exerts no permanent effect on *Entamoeba coli* infections; in fact it is doubtful if the drug exerts any effect on any protozoan except *E. histolytica* save when the drug is applied in vitro. This might be offered in explanation of the failure to find cysts during the progress of the cases; but that will hardly explain the entire matter. Virtually all the cases of *E. coli* infection found by me in the other groups were passing cysts in numbers that admitted of their ready detection and identification. If, on the other hand, some of the amoebae identified in the hospital laboratory as *E. histolytica* really were of that species, as possibly some of them may have been, it is almost impossible to believe that some of the patients would not have passed cysts at some time before discharge. Moreover, three cases were found in which the laboratory reported the stools negative before treatment was instituted. The identity of these cases as ones of acute amoebic dysentery immediately becomes open to serious question.

The amount of emetine administered to one hundred and five of these men presents a rather interesting subject for speculation. This data has been assembled in Table 3.

TABLE 3.—*Emetine Administered to* 105 *Men before first Negative Stool Examination and Total Amount Administered*

First negative report—cases	*Grains of emetine**	*Total amount given—cases*	*First negative report—cases*	*Grains of emetine**	*Total amount given—cases*
6	⅓	1	3	7	19
19	⅔	4	2	8	10
23	1	3	2	9	10
29	2	4	3	10	2
38	3	10	..	11	1
20	4	16	..	12	3
8	5	11	..	13	1
8	6	9	..	14	1

*1⅓ is recorded as 1; 1⅔ is recorded as 2, etc. In doubtful cases it is assumed that the patients received an average of two-thirds of a grain per day.

Three patients were declared negative before treatment was started, in nine there was no record of a negative finding, three appear still to

have been positive after treatment, there is no record of treatment in forty-eight cases, the total was not stated in seventy-five cases, and nine gave no laboratory findings; therefore those cases were thrown out of the calculations.

It will be seen that ninety-seven of the hundred and five men received a total of less than 10 grains of emetine each. Under such treatment from 35 to 40 per cent, at least, of those men should have been expected to relapse clinically, or show cysts of *Entamoebae histolytica* in their feces after treatment, had the original diagnoses been correct. The hospital records, however, yielded no evidence that this happened. A protozoological survey of these men, if properly conducted, should disclose a large number of carriers of *E. histolytica* if they were originally infected. Tables 4 and 5 also are instructive:

TABLE 4.—*Carriers without Acute Dysenteric Symptoms*

Case No.	Days in hospital	Diagnosis	Treatment
1	13	Heart trouble	Quinine enemas, emetine, bismuth.
2	13	Dengue	Bismuth.
3	11	Dengue. Cysts *E. histolytica on admission.*	Emetine.
4	21	Dysentery	No record.
5	12	Tuberculosis	Quinine enemas and emetine.
6	20	No record	None.
7	17	Dengue	None.
8	17	Dengue	Quinine enemas and emetine.
9	19	Dysentery	None.
10	14	Dysentery	"Dysentery treatment."
11	18	Dysentery	Quinine enemas and emetine.
12	10	No dysenteric symptoms	Emetine 2 grs.
13	11	Dysentery	Emetine 7 grs.
14	13	Dysentery	Emetine 2 grs.
15	13	Tuberculosis	None.
16	9	Dysentery	Quinine enemas and emetine.
17	22	Pain in hips and legs	Quinine enemas and emetine.
18	20	Mastitis	Emetine 7 grs.

The data in Table 4 are not such as would justify sweeping statements, but it is pointed out that, according to the laboratory data, all these cases were *carriers*, not cases of acute dysentery. It will be seen that in several instances the number of days spent in the hospital by the individual men was out of proportion to the gravity of the conditions with which they were supposed to be suffering in addition to their amoebic infection. The impression, therefore, becomes very strong that the protracted periods of time spent in the hospital by some of these men were largely devoted to clearing them of an infection which it is not by any means certain they possessed.

Table 5 gives a list of men admitted for the treatment of other

diseases, on whom a second diagnosis of acute amoebic dysentery was made.

Table 5.—*Cases Treated on a Second Diagnosis of Acute Amoebic Dysentery*

Case No.	*First diagnosis*
1	Muscular rheumatism (*E. histolytica* once in three examinations).
2	Contusion of right eye.
3	Lobar pneumonia.
4	Observation for tapeworm.
5	Pyorrhea alveolaris.
6	1. Malaria. 2. Amoebic dysentery. 3. Appendicitis, acute catarrhal.
7	Arthritis, acute, non-suppurative, knees.
8	Tertian malarial fever.
9	Mumps.
10	Dengue.
11	Observation for cardiac disease.
12	Dengue.
13	1. Gonorrhea. 2. Orchitis. 3. Amoebic dysentery.
14	1. Chancroid. 2. Entamoebic dysentery, acute.
15	Tertian malaria.
16	Salvarsan reaction.
17	Nocturnal enuresis.
18	Tertian malaria.
19	Dengue fever.
20	Dengue.
21	1. Tuberculosis. 2. Bronchitis.
22	Dengue.
23	Dengue.
24	Dengue.
25	Dengue.
26	Dengue.
27	Dengue.
28	Otitis media.
29	Dengue.
30	Dengue.
31	Arthritis, acute, left knee.
32	Tertian malaria.
33	Tertian malaria.
34	Tuberculosis, pulmonary, chronic.
35	Bronchitis, acute.

I have not regarded it as necessary to present the details of the above cases. Suffice it to say that the second diagnoses all were based on reports from the laboratory which in all probability were incorrect in every case. It is not at all likely that any of these men ever would have come under antidysenteric treatment had they not come into the hospital for treatment on the first diagnosis.

Viewing the other side of the picture, one at times sees a lack of conformity between clinical and laboratory opinions and findings in a case. This sometimes is due to the lack of confidence in the laboratory findings or misinterpretation of dependable reports. A diagnosis of non-specific intestinal disorder such as enteritis will be made flatly in the face of laboratory reports that should have suggested the diagnosis of dysentery. Cases have already been mentioned in which the diagnosis of "dysentery, entamoebic acute" was made and emetine treatment administered on a laboratory finding of *Entamoeba coli*. Of course the

laboratory cannot be held responsible for the incorrect classification of the case or for treatment administered under these circumstances.

On the other hand, there is too much dependence on the part of the clinical man on a report of a specific etiological factor as *E. histolytica* or *Bacillus dysenteriae* in making a diagnosis of dysentery and the disregard of the cytological picture of the stool as reported by the laboratory, and the clinical aspect of the case. A negative bacteriological report unduly influenced the clinical men, and they failed to appreciate the limitations of the time-consuming and vagarious bacteriological methods.

The situation calls for the closest cooperation between the clinical and the laboratory man with an exchange of visits between the bedside and the laboratory and a common digest of the findings in the two situations.

In attempting to analyze case histories, there are several difficulties encountered that make accurate deductions uncertain or impossible. These are the result, first, of faulty observations and, second, inaccuracy or omissions in records. In the study of such a disease as dysentery, points that might seem of little consequence become very important factors in the subsequent interpretation of the case, the most striking examples being the number and character of the stools.

It is realized that it is very difficult for the nurse to keep accurate check on the bowel movements of each patient, especially when the ward is full of intestinal cases, for she must depend largely upon either the patient or the corps man for the information, but there would seem little excuse for records as obviously inaccurate as the four following examples culled from a number of similar ones found in going over a large group of case histories recently. In the first case, with a diagnosis of "dysentery, entamoebic, acute," it is shown that after the first day on which no bowel movements are recorded, the patient is stated to have had a stool history as follows:

Day........................	1	2	3	3	5	6
Stools........................	0	no record	1	0	no record	0

In other words, we can be sure of only one bowel movement in six days. Again, one with the same diagnosis, whose history records 1 to 20 movements a day before admission, and in which there is no record for the first three days thereafter. The third, whose record for the first eight days after admission runs as follows:

Day........................	1	2	3	4	5	6	7	8	9
Stools........................	no record	0	0	0	0	0	no record	0	4

This gives the impression that the bowels did not move during this period of eight days, which is rather inconsistent with the diagnosis in this case of "Dysentery, entamoebic, acute."

Finally, in the case of the patient whose stool record is as follows:

Day	1	2	3	4	5	6	7	8	9	10	11	12
Stools	no record	1	1	0	0	0	0	0	1	0	0	1

or, in other words, a total of four movements in twelve days, again in the face of the diagnosis of "dysentery, entamoebic, acute."

Blood in the stool is a common symptom of dysentery and an important point in its differentiation, but in a number of cases the observation as to the character of stool recorded was that of the patient, a not too reliable source of information on that point. This arises through a lack of knowledge, and at times a willingness to be accommodating in the furnishing of what he supposes to be the desired answers to inquiries. Moreover, it is not always easy to detect, on casual examination, the presence of blood and mucus in stools, especially in the early stages when there is still more or less feculent content to the stool.

While carefully prepared laboratory records will include the gross appearance of the stools, it would seem that this should also be a part of the clinical record, for the ward surgeon interested in his cases will make a personal inspection of stools, particularly in this class of conditions, for he can get in this way first hand information that will be of considerable value to him in the interpretation of the lesion and the progress of the case. Blood may be present in the stool from other causes than specific dysentery, as the irritation of hemorrhoids in the course of a non-specific diarrhea and the general appearance of the stool may suggest some such source.

As illustrative of the value of this information in a study such as this, Table 6 is presented. This was compiled from the histories of one hundred patients with the diagnosis of "Dysentery, entamoebic, acute," and it is to be noted that only 20 per cent of these stools show the presence of blood or mucus, a very low percentage, if the records are complete and the cases were really dysentery. This is one of the links in the chain that throws doubt on the accuracy of the diagnoses.

TABLE 6.—*Characters of the Stools as Recorded.*

Characters		No. of cases
Simple diarrheal		67
Blood and mucus		3
Mucus alone		3
Blood alone		14
Pus		1
Normal		11
No record		1

Furthermore, it must be acknowledged that it is not always easy to properly interpret observations made and recorded by others, even though they may be accurate and carefully set down. For example, the expression "abdominal pain" may mean that the pain is epigastric, hypochondriac or generalized cramps. The use of the term "tenesmus" may be very misleading. If strictly used, it is an important point indifferentiating dysentery from other intestinal disorders accompanied by frequent bowel movements, but it is frequently applied loosely by both patient and physician to express the cramp of a non-specific diarrhea. As a matter of fact, tenesmus, in its strict sense, is associated with lesions lying at the distal end of the bowel. These are very agonizing, much more so than a simple bowel cramp, and they add much to the exhaustion of the patient which factors so heavily in the prognosis of the case.

There is a tendency on the part of many men to gauge the progress of a patient toward recovery on the basis of the number of stools passed each day. While this in a measure is a suggestive one, it may be misleading, and a lessening in the frequency of stools may, in reality, be far from encouraging. One occasionally encounters severe cases of dysentery in which relatively few stools are passed and in which the outcome may be even fatal. The stools should be studied from every angle, for it often will be found that the physical condition of the patient harmonizes more closely with the character rather than the frequency. In amoebic dysentery it occasionally happens that when the patient is treated with heavy doses of ipecac the number of stools increases markedly. If such stools are carefully examined macroscopically and microscopically, it will usually be seen that they are increasingly feculent and that blood, mucus and other dysenteric debris lessens in amount. One may also see a decline in the number of stools in bacillary dysentery, yet examination of them will show them to be mainly composed of necrotic cellular debris swimming in a serous exudate that microscopically resembles the watery fluid diarrhea and may easily be mistaken for such on superficial examination.

The characters of the stools of dysentery occasionally undergo the most erratic and puzzling variations, being one day purulent and the next day bordering on the normal. Their interpretation becomes a very difficult matter, and it is at such times that the closest and most careful study at frequent intervals must be made of the bowel discharges of the patient.

It must also be recalled that the site of the lesion has much to do with the frequency of the bowel movements, as well as with the character of the stool and the degree of discomfort, low lying lesions usually pro-

ducing greater activity of the bowel, more tenesmus, smaller movements and fresher blood.

DIAGNOSTIC TERMS

Mention has already been made of the lack of uniformity in diagnostic terms, and illustrations have been given. In the series of five cases abstracted in the first part of this paper, in which with almost identical clinical pictures five different diagnoses were made, the variation depends largely on the laboratory reports and is more or less excusable. In going over a large number of case histories of gastrointestinal conditions, it became evident that there was a certain amount of looseness in the use of terms. Except, as will be mentioned later, there is probably little harm done, yet it bespeaks a certain amount of carelessness and a tendency to "faddism" rather than an attempt to determine the real nature of the condition.

These terms fall under two groups. The first, in which, with practically identical symptom-complex, the diagnoses varied between constipation, auto-intoxication and intestinal toxemia.

The second series of diagnoses are all found covering another symptom-complex, or used alternately in different combinations of symptoms. These are: Diarrhea, gastritis, enteritis, gastroenteritis, enterocolitis, colitis, intestinal fermentation, biliousness.

These illustrations are given principally as an introduction to an important point in the use of diagnostic terms. About a year after the investigation of the dysentery outbreak at one of the posts, a review of the subsequent histories of intestinal conditions was made in order to determine the effect of the investigation on the situation as it had existed. It was found that great improvement had been made in the laboratory methods and that the incidence of dysentery had dropped to what might be considered normal for that region and the amoebic cases were only very occasionally encountered. But a new situation had developed. With the elimination of amoebic dysentery and the introduction of bacteriological examinations, a series of cases was encountered that, because of negative bacteriological findings, were diagnosed as non-specific intestinal disorders when the clinical picture and microscopical findings as recorded clearly indicate them to be bacillary dysentery, showing that when one set of fallacies in diagnosis is pointed out and appreciated, it easily become possible to proceed to the other extreme of caution and err accordingly.

Three cases will be quoted by way of illustration.

Case A: Male, aged 11 months.
Diagnosis: Colitis, acute catarrhal, cause undetermined.

Onset: Three days before admission with fever and diarrhea.

Laboratory, on day of admission reported a greenish, thick mucoid stool containing blood and mucus. Cultures were negative for pathogenes.

Temperature, 102° on admission.

Patient died, but there was no autopsy.

Case B: Ill one day with cramps, diarrhea. Moderate tenderness of lower abdomen. Stool every fifteen minutes.

Diagnosis: Enteritis, acute, catarrhal, cause undetermined.

Temperature, 100.6° on admission and for two days.

Laboratory: Bloody, thick mucus containing many pus cells.

Case C: Onset with headache, fever, diarrhea, chilliness. No abdominal pain.

Diagnosis: Diarrhea, acute, cause unknown.

Temperature, 102° on admission. Normal next day.

Laboratory: Bloody, thick mucus and pus. Cultures negative, no parasites.

These three patients, with practically identical symptoms that would indicate very strongly bacillary dysentery, were each diagnosed differently. This is probably due in a measure to a certain amount of timidity in making a diagnosis of dysentery without a definite etiological factor having been established by the laboratory. Note has already been made of the difficulty in making bacteriological diagnoses on a considerable percentage of specific bacterial dysenteries and with a picture such as presented by the above three cases, the diagnosis of "Dysentery, acute, type undetermined," or better, "Dysentery, acute bacillary specific organism not isolated" would be much more appropriate. This would bring to light the true state of affairs that is masked by such non-specific diagnoses as were made in these cases.

This timidity was overcome in the following case, and in spite of negative bacteriological findings the case was classed among the bacillary dysenteries where it rightly belonged as proven by autopsy and postmortem cultures. Except for severity, the similarity in symptoms of this case to the three cases abstracted above is apparent.

Filipino civilian, aged 16 years.

Onset sudden with pain in abdomen. There was suspicion of appendicitis, the patient giving a past history to that effect. Was very ill on admission with diarrhea and dizziness. Grew progressively worse and died in a few days.

Diagnosis: Dysentery, bacillary, type undetermined.

Temperature, 101.6° on admission and rose to 105.8° just before death.

Laboratory: Bloody watery stool containing mucus and blood and ova of *Ascaris.*

At autopsy there was found to be involvement of the large intestine

and 16 inches of the ilium. *Bacillus dysenteriae*, Flexner was isolated from intestinal contents.

This patient apparently suffered from a highly virulent Flexner infection, such as is occasionally encountered in Manila and vicinity. The history shows it to have been grave from the beginning, and bacillary dysentery in Filipino children shows a high case mortality. Attention is called to the gross character of the stool in this case. Experience has shown that this serous type of stool frequently indicates a virulent infection, and the prognosis in such cases must always be a guarded one. The symptoms referable to the appendix tended to complicate the picture. This condition is sometimes seen in bacillary involvement of the coecum and lower portion of the ileum and must always be considered when the question of differential diagnosis is presented.

There is one feature of incorrect diagnoses that, while it is subordinate to the more important one of the patient's welfare, is worthy of consideration, and that is the influence on the non-effective rate. This can be illustrated by Tables 7 and 8 that are constructed from data abstracted from the one hundred post-dysenteries to which reference has already been made. Table 7 shows the days of hospitalization and Table 8 the duration of active symptoms.

TABLE 7.—*Days Hospitalization, Each Admission*

Days	*No. of cases*	*Days*	*No. of cases*
3	1	18	6
4	2	19	1
5	1	20	3
6	5	21	1
7	7	22	1
8	9	23	1
9	4	24	5
10	9	26	3
11	10	27	1
12	10	29	1
13	7	31	1
14	7	45	1
15	12	Still in	1
17	3	No record	3

The grouping of about 50 per cent of the cases between 10 to 15 day periods is striking and can be explained on the basis of treatment rather than duration of symptoms, for in the great majority of cases the patients were free from symptoms after the third or fourth day. The routine antiamoebic treatment occupied ten days, which period was prolonged in some instances by the rule of three negative stool findings as a basis for discharge. The protracted hospitalizations were due, usually, to intercurrent conditions, e.g., the 45-day case was one of gonorrhea.

Judging very liberally from the clinical records it is found that the patients were free from symptoms and ready for discharge in the groups shown in Table 8.

TABLE 8.—*Duration of Active Symptoms after Admission to Hospital*

Duration of symptoms, days.	*No. of patients*
1	12
2	14
3	20
4	12
5	11
7	12
10 days and longer	24
Undetermined	11

This illustrates rather graphically the mildness of the great majority of cases, and taken in connection with the previous table of days of hospitalization (Table 7) will bring out the point that the placing of these patients on a routine of 10 days' antiamoebic treatment and holding them for three negative reports without the presence of symptoms of amoebic dysentery increased the hospitalization enormously. Whereas, more than 75 per cent of the men were ready, clinically, for discharge at the end of a week's hospitalization, only about 15 per cent of the entire group were returned to duty in this time. In consequence, the hospital, during the height of the "epidemic," was crowded with ambulent patients who did not need hospital care aside from dietetic regulation, suggesting one of the consequences of the mistaken diagnoses—a not inconsiderable item of unnecessary expense.

The foregoing comments on the case histories and diagnoses raises the question as to the practicability of Form 55 and its supplementary sheets. These naturally are looked to as the probable source of valuable information. Considerable disappointment ensues when the discovery is made in many cases that they do not yield the evidence that it was hoped to find. I do not feel that this is due in any large degree to the system of case records as provided for in Form 55. If these are fully and correctly filled out, they should be rich in information of the character sought. Incompletely or incorrectly executed, they become a source of perplexity and error, and studies and statistical computations with them as a basis can only be replete with errors.

With specific reference to the feces report sheet, it is in the main adequate and adapted to the purpose, provided the microscopist reports the presence of macrophages and the like under "Miscellaneous."

Except in emergencies, there would appear to be little excuse for carelessness or neglect in the making of entries on Form 55. Properly executed, these case histories can become valuable not only for statistical purposes, but in investigations of this kind, and even to certain problems

in research. It is after the attempt to gather pertinent information from these case histories that one becomes thoroughly impressed with the importance of carefully conducted routine work. There often is little indication in the histories that they have been critically reviewed by anyone before filing. Such a review is desirable and helpful not only from the viewpoint of statistics by assuring at least a certain amount of uniformity, but for the benefit of the ward surgeon as well. This review should be critical and constructive and made by a senior clinical officer rather than the commanding officer, who frequently has been out of touch with clinical work so long as to lose the keenness of perception for the finer discrepancies in the record.

Aside from the foregoing, these records must be regarded as especially important in chronic recurring disorders such as malaria and amoebiasis. Probably the most glaring deficiencies noted in the case histories have fallen under the heading of progress reports and the entering of temperature, pulse and stool records and treatment. I am unable, after inspection of many hundreds of defective case histories, to see how any dependable conclusions regarding symptomatology and treatment can be drawn from a study of the general run of these case histories alone.

TRANSMISSION

An exhaustive discussion of the epidemiology of the dysenteries will not be undertaken, but only two phases of the subject emphasized—the carrier and water as transmitting agents. As an outline, it might be stated that the human carrier, as far as is known at present, is the only practicable reservoir, and dissemination is brought about by direct contact, the contamination by his feces of vegetables eaten raw, distribution by certain arthropod vectors as flies and cockroaches and possibly by water.

The question of the transmission of the dysenteries by food handlers is an important one in the Army, particularly in the tropics, where so much of this class of work is performed by natives. It is the habit in most messes to employ natives as kitchen police and waiters and even cooks and bakers in some instances, and practically all the officers employ native or Chinese cooks and house-boys. The discussion must be taken up under two headings as there are several points of difference in the relation of food handlers to the dissemination of dysentery depending on the type, whether amoebic or bacillary.

Carriers

The problems presented by the carrier of *Entamoeba histolytica* is particularly elusive from the sanitary viewpoint. *There is no evidence at present that persons suffering from acute amoebic dysentery are able to*

transmit it to other persons. The dissemination is carried out by persons who may never have suffered from even the slightest dysenteric symptoms—persons who have harbored the organism for months or even years, but who daily are discharging great numbers of cysts in their feces. It is impossible to detect these persons by any but microscopical methods. The mere fact that a person may harbor *E. histolytica* for years and experience no ill effects therefrom is no criterion that the cysts he has discharged and which have found their way into the alimentary tract of another person may not promptly set up acute symptoms of one kind or another in the second person. There is no way of foretelling the effects of wide dissemination of *E. histolytica,* for these infections apparently are governed within the host by conditions of which we have at the present time no precise knowledge. While statistics indicate that the incidence of acute dysentery in persons infected with *E. histolytica* is very low, we have no criteria for determining whether any particular infected person will quickly come down with dysentery or hepatic amoebiasis, or whether he will remain a healthy carrier for an indefinite period of time.

However, with a high incidence of infection with *Entamoeba histolytica* among a group of food handlers, it is exceedingly likely that many of them will, in time, pass on their infections to some of those who have eaten the food that they have handled. But even this should not lead to conclusions that are too sweeping, for many factors are involved in the biology of the amoeba.

Unencysted amoebae leaving the intestine of man are incapable of infecting other people. They quickly perish on reaching the outer world. Moreover, encystation of the amoeba before it leaves the intestinal tract only partially protects it against untoward environmental conditions. The cysts of *Entamoeba histolytica* are resistant to all chemical reagents that can safely be applied to drinking water, and in the presence of moisture, and in the absence of excessive bacterial influence, they may remain viable a matter of weeks or even months, the precise limit of their viability under natural conditions has never been determined, but their span of life is relatively short—much shorter than that of the intestinal coccidia or the helminths.

The one environmental factor that quickly terminates their life, and which is very common, is desiccation. Desiccation kills the cysts of most of the intestinal protozoa of man with great rapidity, and *Entamoeba histolytica* seems to be especially sensitive to drying. This factor therefore becomes very important when considering evidence of dissemination of *E. histolytica* infections from human carriers, flies and other animal vectors. That is to say, each infected food handler must

be considered in strict relation to the nature of his duties in connection with the food. The object there is to determine if his relation to the food eaten by others is such that the cysts he discharges will escape death by boiling or desiccation, before they can enter the mouth of another. If his duties are such as will enable cysts from his hands to elude death by boiling or to escape desiccation long enough to be taken in by another, he is a real source of danger. If he is engaged in preparing food that is later to be cooked or merely carries utensils that are dry and likely to remain so for a while, he is less dangerous. In any event, however, it is probably wise to eliminate all carriers of *E. histolytica* from the ranks of food handlers and place them on other duty.

As illustrative of the method of carrying out this investigation into the relation of human carrier to a specific problem of dysentery, there is presented the following data collected as the result of the examination of 375 food handlers on duty in the various messes of the organizations on the post where occurred the "epidemic" of amoebic dysentery already quoted.

Inasmuch as human carriers rank high as disseminators of *Entamoeba histolytica* infection, these food handlers were expected to furnish valuable data bearing on the problem. This was deemed especially important in view of the strict embargo that the post surgeon already had placed upon vegetable products designed to be eaten raw, and the high improbability that the water supply played any part in the dissemination of *E. histolytica* infection.

TABLE 9.—*Infected Food Handlers by Organizations*

Organization	*Total men*	*Filipino*	*Chinese*	*American*	*Infected*
A	37	37	....	....	34
B	16	16	....	....	15
C	3	3	....	....	3
D	5	5	....	....	5
E	1	....	....	1	0
F	12	....	....	12	8
G	54	18	36	....	52
H	20	3	....	17	12
I	8	4	....	4	5
J	6	4	....	2	6
K	5	....	....	5	3
L	14	7	....	7	8
M	14	7	....	7	11
N	13	6	....	7	9
O	149	71	....	78	105
P	6	4	2	....	6
Q	8	....	8	....	6
R	4	....	4	....	2

Of the 375 men, 185 were Filipinos, 140 were Americans, and the remaining 50 were Chinese. Of the entire group 290, or 77.3 per cent, were found to harbor one or more intestinal animal parasites or to carry

other organisms of a vegetable nature that indicated coprophagia. Of the Filipinos, 176, or 95 per cent, were infected. Of the Americans, 69, or 49.2 per cent, were infected, while the Chinese yielded 45 infections, or 90 per cent. The distribution of this by organizations is shown in Table 9.

Hyperparasitism was common in the group, more than 25 per cent of the men harboring more than two species of parasites. This is set forth in Table 10.

TABLE 10.—*Distribution of Species of Parasites among Races of Hosts.*

No. of species	*Filipino*	*Chinese*	*American*	*Total*
One	41	15	46	102
Two	73	19	19	111
Three	39	8	6	53
Four	8	2	....	10
Five	8	1	....	9
Six	1	....	....	1
Seven	1	....	....	1

Supplementary to the above is given Table 11, which shows the relative distribution of protozoa and helminths within the three race groups:

TABLE 11.—*Distribution of Protozoa and Helminths among the Race Groups*

Parasites	*Filipino*	*Chinese*	*American*
Helminths only	210	39	21
Protozoa only	6	1	39
Protozoa and helminths	41	12	12

I shall not give the detailed findings of these examinations, but shall, instead, present a summary of the infections which were chosen as a basis for a discussion of the relations of parasitism to the problem of dysentery at this post. These are presented in Table 12.

TABLE 12.—*Summary of Important Parasitic Infections*

Race	Entamoeba histolytica	Entamoeba coli	Endolimax nana	Iodamoeba butschlii	Giardia intestinalis	Balantidium coli	Hookworm	Ascaris lumbricoides	Trichuris trichiura	Strongyloides	Hymenolepis
American	6	23	11	2	2	.....	9	19	4	1	1
Filipino	12	19	7	3	1	1	119	85	114	.....	.....
Chinese	3	4	1	.....	.....	.....	21	19	36	.....	.....
Totals	21	56	19	5	3	1	149	123	154	1	1

By the above table it will be seen that 5.6 per cent infections with *Entamoeba histolytica* were detected, these being apportioned among

the three race groups as follows: Americans, 4.1 per cent; Filipinos, 6.4 per cent, and Chinese 6 per cent.

Hookworm infections amounted to 39.7 per cent of the entire body of men distributed as follows: Americans, 6.2 per cent; Filipinos, 63.9 per cent, and Chinese, 42 per cent.

Infections with *Trichuris trichiura* were present to the extent of 41 per cent in the entire body of men, likewise distributed as follows: Americans, 2.7 per cent; Filipinos, 51.2 per cent, and Chinese 72 per cent.

With these figures as a basis, the significance of this feature of the investigation may now be discussed:

Infections with Entamoeba histolytica

All of the twenty-one cases of *Entamoeba histolytica* infections were detected through the finding of encysted forms of the amoeba, no trophozoite or precystic forms having been identified, as *E. histolytica*. In other words, all of these men were carriers, whose stools gave no evidence of any prevailing acute process.

Where the identification of the tissue-dwelling forms or trophozoites of *Entamoeba histolytica* is relatively simple in the presence of an acute dysenteric process where the stool contains many actively moving amoeba containing phagocytized erthrocytes, the task is much less simple in the carrier cases. It therefore becomes necessary to digress for a moment to discuss these difficulties, repeating, by way of emphasis, some of the points already mentioned.

During the quiescent periods of *Entamoeba histolytica* infection, the stools usually are well formed and contain no appreciable amounts of material that can be regarded as pathological. Above all, no amoebae containing red blood cells will be found, and one of the readiest means of identification of this species is thus lost to the microscopist, and he has to rely on certain rather intimate cytological characters that often require to be interpreted with care and judgment. I shall not enter into the details of these differential characteristics, for this information is available elsewhere, but shall simply point out a few of the pitfalls that await the novice and that have led to incorrect identification of species on countless occasions.

In the normal stool of a carrier, *Entamoeba histolytica* appears in two forms representing steps in the life cycle. These forms are the precystic and encysted stages. Both may appear coincidentally or either may be lacking. Suggestive evidence is offered, as has been said, by the finding of Charot-Leyden crystals. These were observed five times in the study of this group of food handlers, and in only one

instance did they appear in the feces of an infected man. This will serve to explain why more stress is not laid upon them. Precystic forms of *Entamoeba histolytica* and *E. coli* are of frequent occurrence in the feces, and their differentiation often presents real difficulties even to the experienced microscopist. Any diagnosis made on the basis of precystic forms should be made tentatively and with reservation, until subsequent study reveals the characteristic cysts of one or the other species or both. Above all, diagnosis on this form alone should never be attempted by the inexperienced.

Some of the standard textbooks on tropical medicine make a rather simple matter of the diagnosis of the cysts of the two species of *Entamoeba*, and it is only by bitter experience that the laboratory man learns that the cysts present in the stool do not fall sharply into two groups—the four-nucleated cysts or cysts of *E. histolytica* and the eight-neucleated cysts or cysts of *E. coli*. He learns that many subjects produce cysts in undeveloped stages, and he further finds that these cysts do not proceed to full development even when the stool is allowed to stand. He also learns that the size of cysts afford no criterion for the identification, and that, *mirabile dictu*, four-nucleated cysts of *E. coli* are not of infrequent occurrence. Moreover, he runs into confusion when he encounters oval cysts.

In other words, he is confronted with a series of problems in cytology, for his identification of such cysts depends on his knowledge of the comparative morphology of the organisms involved, particularly the morphology of the nucleus. The points of differentiation are fine, but not too fine for appreciation after proper training and experience. He learns among other things that the close study of a four-nucleated cyst of *Entamoeba coli* almost always reveals stages of mitosis in one or more of the nuclei showing that it is in a stage of development to a cyst containing more than four nuclei, it being a safe assumption, then, that the cyst is not one of *E. histolytica* without reference to the morphology of the nuclei, for cysts of that species containing more than four nuclei are so rare as to justify that assumption in practice.

These are a few only of the many misleading factors that enter into the detection of carriers of *Entamoeba histolytica*. With them must be reckoned the confusing pictures presented by concomitant infections with other species of intestinal amoeba, flagellates and the like, *Blastocystis*, large yeast and fungous forms and organic debris that mimics the cysts or ova of parasitic organisms. Back of it all lies the intermittent appearance of these objects.

All these things were, of course, considered in the study of these food handlers and other groups of men. As has been said, it is not

certain that every infection with *Entamoeba histolytica* was detected. On the contrary, it is very likely that some were missed, but at the same time, on the basis of the evidence collected, I am firmly of the belief that the incidence of *E. histolytica* at this post did not exceed 10 per cent among the Americans, at the outside, and that it probably was not much above 12 to 15 per cent in the general run of the natives. It may be higher among the residents of an adjoining barrio, but the survey did not extend to that place.

As has been said, six American food handlers were found to be infected with *Entamoeba histolytica*. Information regarding the previous residence of four of these men is as follows:

A. Had resided in Mississippi and Missouri. He had been in Philippines eighteen months.

B. Had resided in Bohemia, California and Siberia. In the Philippines one year.

C. Had resided in Ohio and California. He had been in the Philippines one year.

D. Had resided in Pennsylvania. He had been in the Philippines eight months.

None of these men ever suffered from dysentery.

The results of the examination of these food handlers make it very clear that the incidence of *E. histolytica* among them was scarcely high enough to warrant the assumption that they were spreading the infection to any considerable extent. It also must be borne in mind that many of them were on duty simply as kitchen police and had little to do with the actual preparation of food. Table 13 was prepared to determine if any connection could be established between the number of cases of dysentery reported from the various organizations and the carriers found in them.

Table 13 is of little value, except negatively, in studying the effect of *Entamoeba histolytica* food handlers on the dysentery rate, for it must be remembered that, with few exceptions, the dysenteries reported proved to be, with but little doubt, bacillary in type rather than amoebic. It is possible that a certain amount of transmission of infection took place, the infected ones failing to develop dysentery. This could be determined only by the examination of the entire personnel. But it is certain that the carriers were not a factor in this particular outbreak of dysentery. The cause was a more generalized one. The general distribution of the cases through practically all the organizations will be noted and there is a very bizarre relation between the presence of carriers and the number of cases that developed in the different organizations. For example, in several with the largest number of cases, as

1, 2, 7, 8, 11, 39, 50 and 52, no carriers were found among their food handlers, while in organizations 14, 20, 28, 40, 43, and 51, with few cases, and 38, 47, 55 and 56, with no cases, all were exposed to carriers.

TABLE 13.—*Organization Distribution of Cases of Dysentery and Carriers of Entamoeba histolytica*

Organization	*Dysenteries*	*E. histolytica carriers*	*Organization*	*Dysenteries*	*E. histolytica carriers*
1	15	0	29	3	0
2	19	0	30	1	0
3	1	0	31	5	0
4	0	1 (A)*	32	3	0
5	10	1 (F)*	33	2	0
6	7	0	34	2	0
7	12	0	35	3	0
8	16	0	36	0	0
9	3	0	37	1	0
10	0	0	38	0	2 (F)
11	21	0	39	26	0
12	14	2 (A.F.)	40	11	2 (F)
13	7	0	41	19	1 (A)
14	6	1 (F)	42	18	2 (A)
15	5	0	43	3	1 (F)
16	9	0	44	0	0
17	7	0	45	9	0
18	0	0	46	0	0
19	2	0	47	0	1 (A)
20	7	1 (A)	48	8	0
21	2	0	49	6	0
22	0	0	50	16	0
23	4	0	51	2	1 (F)
24	10	0	52	14	0
25	0	0	53	3	0
26	2	0	54	2	0
27	4	0	55	0	1 (F)
28	3	1 (F)	56	0	3 (C)*

* A, American; F, Filipino; C, Chinese.

While the examination of the food handlers did not yield a large number of *Entamoeba histolytica* carriers, there is no means of knowing how far these men factored in the dissemination of bacillary dysentery. Their occupation, however, suggests their possible complicity in the spread of the disorder and bespeaks careful medical supervision of them at all times. Carriers of *Bacillus dysenteriae* are much more difficult to detect than are carriers of typhoid and cholera bacilli. The sick records of the food handlers gave little suggestive information on this point.

In the case of the particular group discussed above, the conditions were not favorable for the examination for *Bacillus dysenteriae*. The majority of the stools were several hours old when received or examined, which alone precludes satisfactory results. In addition carriers usually excrete a small number of bacilli and perhaps intermittently and their detection requires thorough investigation.

While in amoebic dysentery there is little likelihood of dissemination of the infection during the acute stage, it is the acute case of bacillary dysentery that is the chief source of infection through direct or indirect contact. The percentage of carriers developed in bacillary dysentery is small, it having been estimated as 3 per cent, and according to Fletcher[7] few remain infected after nine months. The carriers of the Flexner group are more common than those of the Shiga and are really more dangerous, because they usually are healthy, and may escape detection, while the Shiga carrier usually is suffering from a chronic ulcerative condition of his colon and is more or less of an invalid and apt to be under observation.

In the examination of this group of food handlers it was found that the feces of 12 per cent of them showed evidence of chronic ulcerative processes in their intestinal tract. It cannot be assumed that these men were all post-dysenterics, but that possibility is suggested in at least a proportion of them and emphasizes the necessity of transferring all men with intestinal disorders of this sort to some other line of work. As has been stated, it is difficult or impossible to collect evidence that would determine the exact part that food handlers played in an outbreak of bacillary dysentery, but their rôle must be carefully reckoned.

The examination of the food handlers at a large post imposes a heavy burden on the laboratory staff. This burden becomes particularly heavy if the effort is made to carry it out in a manner that will bring about the detection of carriers of protozoan parasites. It likewise calls for the services of well-trained and experienced men such as it is not possible to have always on hand.

The method of collecting the samples of feces directly from the rectum has some advantages from the bacteriological standpoint, in that fresh material is secured for culture. However, at least a portion of the entire stool generally will render better results in the search for animal parasites.

It is believed that the examination of the food handlers should be made with greater thoroughness. These examinations should be especially directed against *Entamoeba histolytica* and the organisms of cholera and typhoid. Examinations for *Bacillus dysenteriae* are not likely to be productive of results. Above all, supervision of the men should be closer, and all men showing symptoms of gastrointestinal disorder of any nature should be immediately detached from this duty and placed under clinical observation and their feces subjected to careful bacteriological study. Furthermore, no new man should be

[7] Fletcher, W., and Mackinnon, D. L.: Medical Research Committee. Special Report Series No 29, 1920; Macalister, G. H. K.: Brit. M. J., Nov. 12, 1910, p. 1506.

placed on this duty until his feces have been examined bacteriologically and microscopically, on no less than six separate days. This is especially important in the case of natives, and Americans from the Southern United States.

It is questionable whether it is necessary to examine the food handlers every month where the sanitation is good. Rather it would be better that the examinations of permanent food handlers be made less frequently, even only twice a year, but with greater thoroughness. Above all, it should be borne in mind that examinations for hookworm and protozoa, particularly *Entamoeba histolytica* and *Balantidium coli*, are quite as important as the usual search for cholera and typhoid bacilli.

WATER

It is, as has been said, improbable that water is concerned to any extent in the transmission of amoebic dysentery. The cysts of *Entamoeba histolytica* may live in water for as long as a month. They are very sensitive, however, to unfavorable conditions, particularly desiccation and sunlight. High bacterial concentration will destroy them in water as well as moderately high temperatures. In order to bring about dissemination by drinking water, there would have to be a very rich infection with cysts at its source for sedimentation and other influences greatly reduce them. It must also be remembered that there is no increase in numbers as there is in the case of bacterial contamination. It is conceivable that a well in which the water was stationary and heavily contaminated with infected feces might be a source of danger, but under usual conditions it is unlikely that drinking water is a factor in the epidemiology of amoebic dysentery.

It is a different matter in the case of the bacillary dysenteries, especially of the Flexner strains. The Shiga organism lives but a short time in water, so it is seldom that this type is water borne. The Flexner strains, however, are resistent and there is no question but that drinking water is a source of danger. This can be illustrated by the experience at the post under discussion. There was a shortage of water for drinking and sanitary purposes, and it was necessary to place the post on water ration, resulting in the turning on of the supply for a short period several times a day. It required considerable effort and ingenuity to bridge over the interim. The water was known to be contaminated, and there were strict regulations regarding the boiling of it for drinking purposes. There was carelessness, however, at times, except in the case of one organization where conditions were particularly favorable for strict enforcement of the regulations. Here the supply was very carefully supervised. The organization had its

own tank, assuring a continuous supply, and the water for drinking was boiled in a large tank by means of steam. The members working about the post carried this boiled water with them in canteens, thus assuring at all times an uncontaminated supply. There were practically no cases of dysentery among the members of this group during the time that there was so much in the other organizations except an occasional case of amoebic dysentery in which the infection was doubtless contracted before the men came to the post. There had been many cases of intestinal disorders in a nearby outfit. They ceased abruptly after a pipe had been run from the tank of the above organization and water supplied to the men from that source.

TREATMENT

The discussion of treatment will be confined to the specific phase of the subject without attempting to detail the complete management of individual cases.

Before attempting the treatment of the dysenteries, it is essential to have a knowledge of the pathogenesis and pathology of the conditions as well as an understanding of the biology of the *Entamoeba histolytica* in that form of the disease, and to be able to interpret, in terms of pathology, the symptoms and laboratory findings as they are presented during the course of the disease.

BACILLARY DYSENTERY

Judging from personal experience, there seems little doubt of the efficacy of *polyvalent* antidysenteric serum in the treatment of bacillary dysentery. There are several principles that must be borne in mind, however, that are influential factors in determining the results. The pathology develops rapidly after infection from exudate, through necrosis to ulceration, and the serum must be given early and liberally to overwhelm the toxin and prevent too much damage to the colon and general system. It is to be expected, therefore, that with a virulent infection of several days' duration little effect on the pathology will be had from the use of serum. Likewise in chronic cases, with extensive ulceration and complicated by secondary infection, little benefit will be derived.

There seems to be a certain amount of hesitancy in the use of the serum that almost amounts to timidity. This is not justified by the results following its use in thousands of cases in all parts of the world. No harm results from its use, except that incident to the use of any serum, but it cannot be emphasized too strongly that it must be used early. To wait for a confirmation of a suspicious bacillary dysentery by bacteriological examination is often to lose valuable time and subject

the patient to a day or so of unnecessary discomfort if not actual danger. The relief from symptoms is usually striking after an injection of 20 to 30 c.c. of serum. One dose may be all that is necessary, but if the stools continue to be frequent and bloody and mucoid in character, the injection should be repeated at intervals of six to eight hours.

Fortunately, the majority of infections are with a mild strain of Flexner bacillus, that usually clear up spontaneously in a short time, but in the Shiga and virulent Flexner infections, the hope of the patient lies in the early administration of the serum, and it is because of the latter cases that it is not safe to delay. It is the habit in Manila, therefore, to give a dose of 20 to 30 c.c. of serum at the earliest opportunity to a patient showing frequent, bloody, mucoid stools in which amoebae have been excluded by direct examination.

In children in which even the Flexner infections are more apt to be severe, the early and free use of the serum is particularly important. The dose is usually modified somewhat for children, running from 5 to 15 c.c. subcutaneously, depending on the age.

While the serum is usually administered hypodermically, attention is called to the good results obtained by Lantin[8] by the colonic administration of large doses.

AMOEBIC DYSENTERY

Patients under treatment for acute amoebic dysentery or as carriers of *Entamoeba histolytica* should receive not less than one grain, hypodermically, of emetine hydrochloride per day. This should be continued for not less than twelve consecutive days, in the absence of contraindications. In the event that the patient is found still to be parasitized, he should be given a course of 36 grains of emetine bismuthous iodide per mouth, administered 3 grains per day. Following this treatment he should be kept under microscopic observation as outlined below. If, at the end of this time, he is still parasitized, another course of 36 grains of emetine bismuthous iodide should be given. This, of course, presupposes any accessory treatment or modification of treatment that would be indicated by special conditions, and must be left to the judgment of the one in charge of the case.

I am inclined to discourage the use of colonic medication, bearing in mind that Leidy has apparently achieved good results with colonic irrigations of ipecac solution. It is believed, however, that most reliance is to be placed on emetine and emetine bismuthous iodide. It is doubtful if enemas of any sort are of any real benefit in dysentery, particularly the amoebic type. They are very disagreeable, sometimes

[8] Lantin, Pedro T.: "Various Methods of Serum Application in Bacillary Dysentery." Philipp. Journ. Sci., 19, 1921, 629.

intolerably painful to the patient, and if the same point be borne in mind in this connection as is mentioned below in the discussion of "clearing" the patient, it will be seen that, as far as any effect on the amoeba is concerned, little is to be expected. It is possible that *in vitro*, a 1:1,000 quinine solution will kill the trophozoites of *Entamoeba histolytica* and it may possibly have a similar effect on those free in the colon contents, but it is difficult to see how it possibly could have much influence on the organisms buried deep in the intestinal wall. All the patients interviewed were questioned regarding the effect of the quinine enemas, and the majority apparently suffered little pain from them. In these instances it is likely there was little if any ulcerative process present. It is noteworthy that those who had been more seriously ill complained bitterly of the enemas, and it is doubtful if any possible good counterbalanced the additional distress and shock these men experienced from them.

It should be pointed out that emetine is not altogether a harmless drug, and there is considerable evidence in the records that temporary risk, at least, is attendant on its use in certain cases. It is, at times, a disagreeable treatment. A number of men complained of this in our interviews with them. The pulse records show a very large number of cases in which there was cardiac reaction, the pulse rate on discharge after days of rest in the hospital being appreciably higher than on admission even in some of the cases entering with fever. Several cases showed distinct evidence of intoxication. The certainty of an *Entamoeba histolytica* infection should, therefore, be established before beginning its use and it should not be used as is the antidysenteric serum, on a presumptive diagnosis. In addition to the risk of toxic effect, to use it before a diagnosis is established is to cloud the chances of establishing it later much the same as the too early use of quinine in malaria or salvarsan in syphilis. In other words, it should not be used empirically.

Mention should be made of the relation between the amount of emetine administered and the microscopical cures. It is true that the amoeba frequently disappear from the stools during treatment, even after relatively small amounts of the drug have been administered, but it is contrary to all competent experience that a large number remain negative after treatment is stopped. As illustrative of the high degree of resistance to emetine exhibited by *Entamoeba histolytica*, or, differently stated, the ineffectiveness of emetine as a ready sterilizer of *E. histolytica* carriers, reference is made to the experience of the British workers, particularly Dobell,[9] in a series of carefully studied cases, e.g.,

[9] Dobell, Clifford: "Amoebic Dysentery and the Protozoological Investigations of Cases and Carriers." Spec. Rept. Ser., No. 4, Med. Res. Comm., 1917. London, H. M. Stationery Office.

of a group of twenty-one that had received from 11 to 14 grains of emetine each. Of this number, fourteen were found to be infected three weeks or more after treatment had stopped.

The transient effect of emetine as seen in stool examinations made during treatment is strikingly illustrated in the following three records of cases taken from a number of similar ones, reported by Wenyon and O'Connor[2] in connection with their studies of human intestinal protozoa in the Near East. These are set forth in Tables 14 to 16 as follows:

TABLE 14.—*Treatments by Wenyon and O'Connor.* (Case 1.)

Day	*Treatment*	*Laboratory finding*
1	Emetine grs. 1.0	*E. histolytica.*
2	Emetine grs. 1.0	*E. histolytica.*
3	Emetine grs. 1.0	*E. histolytica.*
4–12	Emetine grs. 1.0	None.
13–18	None.	None.
19	Emetine grs. 1.0	*E. histolytica.*

In this case the amoebae disappeared after 3 grains of emetine had been administered, but reappeared after the treatment had been stopped for six days, notwithstanding the patient already had received a total of 12 grains.

TABLE 15.—*Treatments by Wenyon and O'Connor.* (Case 2.)

Day	*Treatment*	*Laboratory finding*
1	Emetine grs. 1.0	*E. histolytica.*
2–5	Emetine grs. 1.0	None.
6–7	Emetine grs. 1.0	*E. histolytica.*

In this case the amoebae disappeared after 1 grain of the drug had been given, and they were absent for four days. But it will be seen that it was not until after 8 grains had been administered that consistent negatives were obtained.

TABLE 16.—*Treatment by Wenyon and O'Connor.* (Case 3.)

Day	*Treatment*	*Laboratory finding.*
1	Emetine grs. 1.0	*E. histolytica.*
2–4	Emetine grs. 1.0	None.
5	Emetine grs. 1.0	*E. histolytica.*
6–12	Emetine grs. 1.0	None.
13–14	None.	None.
15–16	None.	*E. histolytica.*
17	Emetine grs. 1.5	None.
18	Emetine grs. 1.5	*E. histolytica.*

This case became negative following the administration of 1 grain of emetine and was followed by five negatives, but the amoeba reappeared on the fifth day. Three days after the emetine was stopped *Entamoeba histolytica* again reappeared although the patient had received 12 grains of emetine, and it was not until a total of 15 grains of emetine had been administered that consistent negatives were obtained extending at least through an observation of two months.

Another point to be discussed in connection with treatment and stool findings is the generally held notion that it is one matter to find a patient expelling trophozoites of *Entamoeba histolytica* and an entirely different proposition when cysts only are found in the stools. It is only necessary to consider the life cycle of the organism, and the important fact that the treatment is not directed against amoebae and their cysts *in the stools.* The aim is to reach the trophozoites in the tissues. It is true that less headway can be made against well-established chronic infections in which it is customary to find cysts only in the stools, than it often is in the more recently acquired infections undergoing acute exacerbation of dysentery. It often appears that more immediate results can be obtained in the active cases when trophozoites, or tissue-dwelling forms, are present in the stools. But in either case the amoebae that have escaped from the tissues to perish if they do not encyst (and such forms do not encyst under the stress of acute dysentery) need not concern us. They merely are an indication of more fortunate individuals left behind in their natural environment—the tissues of the intestine and their disappearance from the stool and the subsidence of active symptoms under the influence of emetine do not mean that the patient has been sterilized of his infection.

CLEARANCE OF CARRIERS

This brings us to the consideration of another very important matter that has much to do with the welfare of the individual man and the efficiency of the personnel. That is the matter of "clearance" following an accurate diagnosis, and its treatment.

The clearing of cases of infection with *Entamoeba histolytica* should be done with great caution. Every patient finally cleared following a systematic series of examinations *after* the conclusion of treatment, should be followed and periodically reexamined for at least six months or a year. This should be done on precisely the same grounds as the periodic Wassermann examinations that are made of syphilitics. Less work is involved and the necessity is as great, for many cases of relapse and hepatic amoebiases are thus warded off by renewed treatment if the man is found to be still a carrier. Wide experience has shown that a large number of patients who have received even 12 grains or more of emetine at a course will be found to be still infected, and the mere fact that they have suffered no clinical relapse in the intervening period is no guarantee that they will not experience trouble in the future.

The procedure carried out at many of the posts may be satisfactory from the viewpoint of immediate military expediency, but it certainly is inadequate from the viewpoint of the welfare of the individual men

and the ultimate welfare of the unit as a whole. Moreover, if it is determined to return a man to duty on three negative laboratory reports, all of these negatives should succeed the last positive finding and *they should not be made during treatment.* A man may show signs of complete physical recovery and his stool may be negative, yet he may be back in the hospital with an acute dysentery within forty-eight hours, or he may be discharging cysts in considerable numbers which may suddenly be replaced by trophozoites within a short time if treatment has been insufficient. He may, on the other hand be clinically well, but discharging cysts and it may be perfectly justifiable to convert him into an ambulatory case, under suitable dietary restrictions, with treatment daily until he is finally cleared.

However, it seems to be a prevalent practice to order the men back to duty on three negative reports from the laboratory, and no effort seems to be made to keep them under microscopical observation to determine whether or not they still are infected. A series of stool examinations extending over months is difficult to carry out in a group of men who constantly are changing stations, but it usually is easy to keep the men under observation for a period of a month during which time the procedure recommended by the British Committee can be carried out. The procedure is as follows:

Treated cases should be examined six times on six appropriate days—not at random. No negative examination made during or immediately after treatment should be included. The first of the six examinations may appropriately be made three or four days after the end of treatment. (By this procedure many cases unaffected by the treatment will be quickly detected.) The second examination may be made one week after the first (i. e., about the 10th day). The four remaining examinations will be most profitably made a week later, when the infection, if still present, will probably have returned to normal, and will therefore be detected more readily than during the earlier part of the period following treatment. A typical case examined on this system would thus be kept under observation for a period of not less than three weeks *after* treatment. During this time it would be examined six times on approximately the following days after treatment: 4th, 11th, 18th, 22nd, 24th. (The last four examinations could be made on the 18th, 19th, 20th, and 21st if necessary, or extended with advantage over a longer period.)

It is probable from the facts and figures at present available, that examinations made on the above system would give satisfactory results in practice. Probably only a small percentage of infected cases would evade detection.

I would point out in connection with the above that this would not necessitate the retention of the men in the hospital during this period of three weeks. They would be retained in the hospital only if there was

continuance or recurrence of active symptoms or some other condition that would make it undesirable for them to go on light or active duty.

While emetine is the drug *par excellence* in amoebiasis, there are two others worthy of mention. *Castela nicholsoni* (chaparro amargoa is the Mexican synonym) has been used for some time in Mexico with more or less success and Sellards[10] has recently done some experimental work with several allied species.

Haughwout[11] has used benzyl benzoate with some success in both bacillary and amoebic dysentery. He does not claim it to be a specific or a parasiticide, but it does relieve symptoms, particularly the tenesmus, and reduces the number of bowel movements, particularly in low lying lesions.

AFTER CARE

A serious factor in influencing the end results of dysentery cases is diet. Carelessness in the matter of diet is frequently shown in the handling of these patients, without regard to whether the dysentery be amoebic or bacillary. The majority of these patients are placed on full diet entirely too soon after the subsidence of symptoms, and frequently no provisions for the after-care are made. Considerable harm and even chronic invalidism resulted in not a few instances.

It evidences a lack of knowledge of the pathology of the condition to suppose that a patient can handle the rough full ration of the soldier in a day or so after he has ceased having frequent, bloody mucoid stools. Several instances have been seen where return of symptoms were undoubtedly the result of dietary indiscretions. Information was obtained from a number of men that, after return to duty and it became necessary for them to go on company rations, intestinal and digestive disturbances reappeared. It is an unfortunate situation that would be rather difficult to remedy in the service that these and other cases of similar nature cannot have proper after-care particularly in so far as diet is concerned, after their discharge from the hospital. It obviously is impracticable to keep them in the hospital simply for this. This lack of after-care is responsible for actual chronic invalidism and certainly for some readmissions. We obtained frequent microscopical evidence of this lack of after-care in the shape of abnormal quantities of mucus and degenerated pus cells and epithelium that bore evidence of the existence of chronic ulcerative processes in the intestine.

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[10] Sellards, Andrew W.: and Leira, L.: Treatment of Amebic Dysentery. Philippine Jour. of Science, Jan. 1923, 22, 1.

[11] Haughwout, Frank G., Latin, P. T., and Asuzano, M. A.: "Protozoological and Clinical Studies on the Treatment of Protozoal Dysentery with Benzyl Benzoate." 1. A Preliminary Report on Eight Cases of Entamoebic and one Case of Bacillary Dysentery at the Philippine General Hospital. Arch. Int. Med., 24, 1919, 383.

OTHER PROTOZOAL DYSENTERIES

This caption might be in the singular, for there is only one other protozoan that need concern us, namely, *Balantidium coli.* Infection with this ciliate gives a general picture closely resembling in a number of aspects that of *Entamoeba histolytica* infections. Clinically the course is chronic with acute exacerbations that are differentiated from those of *E. histolytica* infections only by identification of the causative organism. The laboratory diagnosis of these infections is relatively simple, for it is one of the most spectacular of the intestinal parasites and, once seen, can scarcely fail to be recognized again. There may be some confusion if only degenerating forms are present. Like *E. histolytica*, *B. coli* is an obligatory tissue parasite, and, unless encysted, it degenerates and dies soon after leaving the gut wall. It is only necessary in speaking of the laboratory diagnosis to sound the warning that the presence of *Balantidium coli* in a dysenteric stool does not preclude the possibility of other etiologic factors and that its finding alone does not necessarily justify a diagnosis of dysentery. The infection in man is not particularly rare, but the majority of the infections will be picked up in nondysenterics in the course of routine examinations, though, as Walker has said, there are very few of the cases that will not at some time have dysenteric attacks and the proportion of simple carriers is much lower than with *E. histolytica* infections.

The pig is considered the natural reservoir of the parasite, and transmission occurs by contamination of food with balantidium *cysts* originating from pig or human carriers.

Unfortunately there is no satisfactory treatment as yet for this infection. In considering cures, it must be remembered, as in the case of *E. histolytica* infections, there is a certain degree of periodicity in the appearance of balantidium in the stools and there is no doubt spontaneous elimination of the infection in a certain number of cases. Haughwout[12] reports an apparent cure of one case by the use of benzyl benzoate, with confirmation of the complete disappearance of the parasite by autopsy. There is at least a favorable influence on the clinical picture, as has been personally witnessed in several cases treated with the drug since the one reported above.

In conclusion, it is desired to make mention of the flagellate infections of the intestinal tract, particularly trichomonas and giardia, for specific dysenteries have been attributed to them. These protozoa are often found associated with diarrheal conditions, or at least are more

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[12] Haughwout, Frank G., and Domingo, E.: "Protozoologic and Clinical Studies on the Treatment of Protozoal Dysentery with Benzyl Benzoate;" 2. "Case of Acute Balantidiosis." Philippine J. Sc., Manila, 1920, 16, 633.

numerous in loose stools. In the light of our present knowledge, however, it does not seem that we are justified in assigning to these organisms any particular amount of pathogenicity. It is easy to conceive that, because of its habitat, *Giardia intestinalis* may cause trouble, but there is no convincing evidence of it as yet. *Trichomonas intestinalis* lives free in the intestinal contents and in diarrheal conditions appears in the stools in great numbers, but this may well be effect rather than cause. It has been described occasionally as having invaded the tissues and it is not uncommon to find them in the stools ingesting and, what is of greater significance, digesting red blood corpuscles, points in evidence of the tendency toward pathogenicity. We may be witnessing the evolution of this parasite to the state of obligatory tissue parasitism.

There is no treatment that is effective against either of these infections.

SUMMARY

In the foregoing an attempt has been made to present the lessons that can be drawn from the mistakes and experience of myself and others in the matter of the dysenteries, and the more important of these can be summarized categorically as follows:

1. Be on the lookout for bacillary dysentery in this country.

2. Make freer use of polyvalent antidysenteric serum in bacillary dysentery suspects.

3. Do not be too dependent on a specific laboratory report in making a diagnosis of bacillary dysentery, but have due regard for the true significance of the gross and microscopic characters of the stools.

4. Base the diagnosis and treatment of *Entamoeba histolytica* infections on sound and accurate laboratory findings.

5. Treat intensively and follow up conscientiously with emetine and emetine bismuthous iodide the case of proven *E. histolytica* infection.

6. Include in the examination of food handlers a search for parasites, especially *Entamoeba histolytica* and hookworm, and finally I would make the rather comprehensive and orthodox plea for more conscientious attention to routine work, especially in the observation and recording of clinical data by ward surgeons and nurses and the careful supervision of case records before they are filed. In this way only can the great amount of material that passes through the hands of the Medical Department personnel be made available for future study.

A STUDY OF INTESTINAL PARASITES OF A SMALL GROUP OF SIAMESE SOLDIERS[1]

By W. H. BEACH, M.D., American Presbyterian Mission, Siam; and H. R. O'BRIEN, M.D., International Health Board, Bangkok, Siam

FROM 1914 to 1917 the senior author conducted treatment for intestinal parasites at the American Presbyterian Mission at Nan, in the Lao states of northern Siam. This treatment was given to patients in the hospital, especially as a routine preoperative procedure; to the pupils and teachers in the girls' school; and finally to a group of 103 soldiers from the barracks of the Siamese army in Nan. It is because the data on this last group are especially extensive and because the men, who were on active duty and apparently healthy, came from all parts of the provinces, that this study is presented as an indication of the probable condition of the young adults of this part of Siam.

Method of Treatment.—The procedure in the treatment of the soldiers was as follows: Preliminary examination of the stools was made for the eggs of the various parasites. It was planned to treat only the men having hookworms, but as every one of the 103 was positive to these parasites, all were treated. The day before a squad was to receive the anthelmintic, each man was given thorough catharsis by a full dose of Epsom salts at 1 p. m. and again at 5 p. m. He ate no supper or breakfast and appeared at the hospital at 7 a. m. the following day. The drug used at first was thymol, administered in three doses an hour apart; a total of 54 grains was the maximum amount given. Later, oil of chenopodium was employed; three doses were administered in capsules at intervals of an hour and a half. The dosage was graduated according to age, weight, and health, and never exceeded a total of 54 minims. While the men were waiting for treatment they were weighed and their hemoglobin estimated by the Sahli method. They were questioned closely as to any history of symptoms that might be due to intestinal parasites, and a physical examination was made to discover other signs of infection. The entire record of each patient was kept on a special card which was filed.

A final dose of salts was given three hours after the last capsule, and the patient was allowed to eat tiffin. All stools passed within

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[1] The studies and observations contributed to this paper by Dr. O'Brien were conducted with the support and under the auspices of the International Health Board of the Rockefeller Foundation.

the first four hours after the administration of the salts were collected and washed, and the worms were counted.[2] Late in the afternoon the patient was allowed to leave the hospital.

General Status of Patients.—The men treated were young soldiers, drafted at random from all sections of the province and brought to Nan for training. They were on active duty and apparently healthy. Their average weight was 109.2 pounds; the Siamese are usually short and stocky. In age they ranged between eighteen and twenty-two, except for two or three officers who were in their thirties. Ninety-four belonged to the Lao, or northern, branch of the Tai race, and eight to the Siamese, or southern, division.

Symptoms of Parasitic Infection.—Ninety-seven of the men treated were questioned in detail; of these, four had felt none of the disturbances common to hookworm infection. Of the remaining ninety-three, forty-six complained of a general and constant tired feeling, five of poor appetite, and four of frequent headaches. Backache had been present in two cases, while twenty-four had experienced frequent pain in the epigastrium, a symptom which might also have been due to rice indigestion. Fifteen had had frequent fever, sixteen had had dizzy spells, and twenty-four had suffered from palpitation of the heart.

Eight of the soldiers had facies that were markedly dull. The leg signs were, however, the most striking outward evidences of infection. Three men had boils on the legs, and in fifty-two patients old scars were present. The senior author considers this symptom almost pathognomomic of hookworm disease in Siam. Thirty-six men had noticeable edema of the legs. It is interesting to note that the severity of the symptoms complained of was by no means proportional to the numbers of worms expelled by treatment.

Hemoglobin.—The hemoglobin rates, as determined for the 103 cases, are listed below.

Hemoglobin reading *Per cent*	*Number of cases*
45 to 54	2
55 to 64	11
65 to 74	31
75 to 84	28
85 to 94	31

The average percentage for the group was 76.0. The men falling in the three lower classes, forty-four in all, may be said to have had

[2] One soldier ran away after the administration of the salts, and his record is therefore incomplete.

a definite anemia.[3] In other words, almost half of a group of "normal" soldiers were anemic. The degree of anemia present did not correspond closely either with the symptoms reported or the number of worms obtained on washing the stools.

Results of Stool Washings.—The stools of 101 of the soldiers were washed.[4] Every one of them contained hookworms—the stools of twenty-nine, or 28.4 per cent of those treated, contained tapeworms, the stools of twenty-one (20.6 per cent) contained roundworms, and the stools of twelve (11.8 per cent) contained whipworms. The hookworm count, of course, is not complete, as additional worms would be passed after 4 p. m. of the day of treatment. The drugs used have their main effect upon hookworms and are not specific for other parasites, but the results obtained are significant. The hookworm counts for 101 cases are listed below.

HOOKWORM COUNTS

Number of worms	*Number of stools*
None	0
1–10	26
11– 20	15
21– 30	13
31– 40	8
41– 50	8
51– 60	5
61– 75	7
76–100	6
101–200	10
201–300	0
301–400	1
401–500	2
	101

The average count was 51.6 hookworms, but the majority of the soldiers had thirty worms or fewer. The two largest counts were 430 and 434. In most cases the worms were *Necatur americanus,* but several patients showed *Ancylostoma duodenale;* in some instances the infection was mixed. The roundworms averaged 2.5 in the cases where they were present. In one case twenty-one whipworms were recovered.

SUMMARY

1. Intensive study was made of the intestinal parasites of 101 young soldiers on active duty in north Siam. The men were examined, treated, and the stools washed. The data are presented.

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[3]The most important causes of anemia in Siam are malaria, hookworm infection, and improper nutrition.

[4]In one case the stool was so small that it was not washed.

2. Infection with hookworm and other intestinal parasites is almost universal in one rural district of north Siam.

3. This infection usually is light, but frequently causes vague general disturbances. A large number of worms, accompanied by anemia, may be found in young men rated as healthy soldiers and on active duty.

SPINAL OR MENTAL? THE USE AND ABUSE OF MANIPULATION

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THE MARROW from earliest times has been looked upon with peculiar veneration as holding a virtue very special though ill-understood and variously interpreted. The spinal marrow was particularly important, and from it the spine itself gained special notice. Besides, did not a broken back paralyze the limbs? And a broken neck the arms too? Since modern studies of embryology, too, the notocord and the neural groove superimposed added further significance to the region of the spine, for was not this involution of the ectoderm the root from which sprang the chief differentia between vertebrate and more lowly creatures?

Again, the anatomy of the spinal cord and the functions of its tracts were among the early acquisitions of modern neurology.

Can we wonder, then, that notions regarding the spine were clothed in superstitions which persist in interpretations of spinal pathology by our medical forebears. Many of us are old enough to remember how the hypothesis of railway spine was built upon the superstition that prolonged vibration of the moving railroad coach would produce a comminution of the spinal marrow too fine to be detected even by the microscope, and that by this ill-founded theory were explained frequent complaints of weakness, pain and such like which were supposed to be the consequence of an accident on the railway. This superstition has been transcended by those of us who have become acquainted with the influence of suggestion, and who have trained themselves to differentiate between the functional disorder known as hysteria and those disorders of function from structural alterations or chemical modifications of the nervous system.

In most people, however, information concerning the spine, its contents and surroundings is lacking or erroneous. Unfortunately for them, there lies ready to hand much false teaching which seeks to give rise to the belief that most human ills are due to displacements of vertebrae so slight as to be detected only by manipulation especially skilful, and that replacement can be accomplished only by the same kind of skill. We know that this is an utterly false

interpretation. However, the public knows that many persons are relieved by those kinds of manipulations and is not at all interested in finding the true explanation.

We know that massage properly performed improves circulation and metabolism in general. We also know that local massage has special results, as, for instance, the removal of headache by stroking the neck, the relief of constipation from deep massage of the abdomen. We do not keep sufficiently in mind, perhaps, that specific reflex effects may be usefully procured by manipulation; and this is more particularly true of martillage of vertebrae or special petrissage over the articular processes. Contractures and rigidities of the muscles of the trunk can be reduced in these ways. Contraction and slowing of a dilated heart may be accomplished. The pelvic circulation may be modified. Of course all these effects are strictly temporary. In this they do not differ from those of a drug, however: each will require repetition unless the patient is rid of the cause of the disturbance.

It must not be understood that the general employment of these measures is advocated. Their applicability is quite limited; but they have a place, which is inadequately envisaged by most of our profession. The result is that many patients are allowed to leave us unrelieved, to be dealt with by men who are dangerous because exceedingly ignorant of the structure and functions of the human body and of the nature of many of the disorders with which they may attempt to deal by measures based upon an exclusive theory.

Some patients, however, are relieved by them. These are of four kinds: Firstly, there are those in whom massage is directly beneficial.

Secondly, there is a minority in whom a special kind of manipulation is really indicated.

Thirdly, there are those who find a greater interest and satisfaction in the kind of active intervention afforded by massage than they do in dieting, drugging, exercising or undergoing a psychological training. These patients of course only remain well while manipulated, and, when they tire of that, seek some other charlatanry.

The fourth kind is the suggestible individual, who is made to believe by the operator's patter that he is going to recover by this agency. This, of course, occurs only when the patient is disordered because of his imagination.

AGAINST SUGGESTION

Superficial thinkers accept this as a desirable eventuality. A little reflection, however, shows how undesirable it is that hocus-pocus should be countenanced; for, firstly, it prevents the patient from knowing the true nature of his disorder and from learning how to deal with it by getting rid of its basis. Secondly, it is undesirable, as all falsehood is, in the sphere of relationship of man with man, a matter, however, not special to doctors, but in which doctors should be as much concerned as every good citizen.

Moreover, not only is this kind of false pretense and indirect suggestion reprehensible, but honest and straightforward suggestion is not the method of choice in dealing with imaginary disease; for it not only leaves the patient with a false notion that he has been ill physically but it adds another false belief that he is being made well physically. There is no insurance against relapse, as there is when the patient is taught that he is not physically ill, and when he learns how to cure himself by an understanding of the influences which have disturbed him, and when he is shown how to deal with them. (See Treat. of Psychoneuroses, Lon. Med. Jour., 1912; Neglected Psychopathy Factor, Jour. Amer. Med. Asso., 1922, Oct. 17; Phobias and Obsessions, Internat. Clinics, 1919; and a book in the press of Little, Brown & Co. entitled, "Dreads and Besetting Fear including Anxiety States.")

REGARDING COMPENSATION

In patients who believe that their spine has been injured, however, the question of compensation for an accident often vitiates a true understanding; and if litigation is engaged in, motives are introduced which tend to interfere with straightforward thinking.

However, even in these cases the obstacle is not insuperable. The two following cases seen about the same time are examples in point. Both these were seen in January, 1920, because of a neurological syndrome subsequent to injury.

In the first case, on examination the patient showed no present sign of organic disease of the nervous system, although he complained that he was entirely unable to move the left lower extremity, and although he showed much impairment of the movement of the left upper extremity.

All the deep reflexes were present, although their response was only slight, except when the attention of the patient was diverted, as when he supported himself sitting up in bed. The cutaneous

reflexes also existed, although those of the left abdomen and the left toe were enfeebled.

There was considerable disproportion between movements of the hand and arm made on request and those movements made involuntarily while the patient was performing such actions as sitting up in bed, accommodating himself to having his clothes removed, the holding of the forearm while the movement of the fingers were being tested.

As to the left lower extremity, although complete incapacity was alleged, active contraction of the ham-string muscles was seen and of the quadriceps muscle was felt by my hand while the patient was turning over in bed. Furthermore, when the thigh was lifted from the bed and I let go the leg after suspending it in the air, there was a marked stay of the fall on one occasion, and there was always a lack of that extreme flaccidity and abruptness of fall which are invariable in complete paralysis of the type known as flaccid.

The apparent inertia of the limb was again contradicted by the very decided pressure on my hand placed under the left heel when he lifted the right leg from the bed. On the contrary, when I asked him to lift the left leg, the fact that no real effort was made was proved by the absence of downward pressure on my hand placed under the right heel.

The absence of muscular atrophy and the presence of myotatic reaction without exaggeration negatives a lesion of the anterior horns of the spinal cord by haematomyelia or otherwise.

There was no sign of spasticity or increased reflexes, which should have already begun had the paralysis been due to a lesion of the upper motor neurone in brain or spinal cord. Again, the reflexes, so far from being more active on the side alleged to be paralyzed, were on the left side rather more feeble than on the right, which, nearly seven weeks after the accident, should not have been the case.

As to the anesthesia alleged, it was very easy by my examination made without ostentation to have him admit that he felt both pin prick and deep blows on portions of the left side of the body.

He complained of severe pains in the small of the back and below when he was placed on his face or on the side. But the spine was freely movable, and in none of my manipulations of the thigh and pelvis was any twinging or flinching observed.

He talked only in a whisper, a sound characteristic of the many

cases of hysterical dysphonia which I have seen after accidents actual or alleged among soldiers during the war.

All these facts concord with an interpretation that the present disability is psychogenetic and that, if the patient were animated by the will to move and were encouraged appropriately to do so, the use of his voice and limbs would quickly be attained. This is true even if at the commencement there had been some concussion along with a temporary physical disability, which I strongly doubt.

Treatment was then undertaken by the patient's physician under my direction and led to complete recovery within a month without accomplishment of the litigation which had been undertaken.

Examination of the second case showed no present sign of organic disease of the nervous system, although the patient walked into my office with the aid of a cane, dragging the left leg.

All the deep reflexes were actively present without inequality. The cutaneous reflexes also existed, although on account of the cold, both plantar reflexes were sluggish.

There was slight flabbiness of the left quadriceps muscle, along with a slight atrophy, which could be accounted for by seven weeks' disuse. The myotatic reaction existed without exaggeration everywhere.

Although the patient made no voluntary move whatever of the leg and lifted the thigh only feebly, yet he raised the limb onto the couch with only slight aid from his hand and without dropping of the foot and toes. Although he failed to lift the limb from the couch when requested, yet when I lifted both limbs in the air, the fall of the left leg was arrested for a moment, and when it did fall it did so slowly. When the patient lifted from the couch the right extended leg, the pressure of the left heel upon my hand was distinct and the contraction of the left ham-strings could be readily felt. This contrasted with the very feeble pressure of the right lower limb when he was asked to raise the paralyzed leg from the couch. Furthermore, in walking no unsteadiness was manifested, and the play of the muscles was evident.

Insensibility is alleged by the patient only to skin stimuli, he admitting that he feels pain when the muscles are squeezed.

In view of the presence of the patient's brother-in-law and his physicians, no explanations were attempted before him, more especially as the patient is of a sensitive type. I believe, however, that he is now in a frame of mind receptive to proper persuasion. Restoration of locomotion should therefore be possible of rapid accomplishment.

The electrical shock alleged, I look upon as a precipitant of a condition already incubating. Into this, however, I did not endeavor to penetrate, in view of the circumstances, merely indicating later to his physicians the desirability of doing so.

His physicians undertook treatment on these lines and procured recovery of the patient in a very short time.

In its essentials the syndrome in this latter case closely resembled a much talked of case which I saw in Norfolk recently, and a very similar report was submitted. Litigation in this case, however, ended in court, as no opportunity was given me of endeavoring to treat the patient. The considerations presented in the report and the testimony of myself and three other experts, however, made clear the mental origin of the syndrome, although the case was thrown out on other grounds.

Such cases could be duplicated indefinitely. (See The Traumatic Neuroses, Amer. Jour. Med. Sci., 1914; Amer. Jour. Crim. Law, 1916.) They were very frequent in the armies during the Great War; but, when met early by skilful neurologists, they were dealt with readily. (See "Management of Military Hysteria," MILITARY SURGEON, Nov., 1919.) They occur in civil life also, and these are the people who, when a proper understanding is not received by them, are very prone to drift into the hands of manipulators. Led by these to believe that there has been a displacement, the suggestion of its reposition may lead to a disappearance of the incommoding symptoms. Even when successful, this is obnoxious, as suggestive therapy usually is, whether frank or concealed in some physical or theological humbuggery.

The proper therapy, of course, is illustrated by the two foregoing cases, in which the patient was educated into a knowledge of the cause of his condition and trained into ways of transforming it into health.

AGAINST MANIPULATION

Even still more undesirable, however, is indiscreet manipulations in the kind of cases now to be discussed.

The frequency of hysteria as the true interpretation of cases when compensation is in question should not be allowed to blind the physician to other possibilities. Mental inertia permits some men to fall into the fatal error of what I have called diagnosis by categories. This verges on the arithmetical procedure of the ship's captain who, finding bottle seven empty, gives his patient equal parts of bottles three and four.

Traumatic hysteria was diagnosed by two psychiatrists in the case of a woman who was entitled to treatment by a compensation commission because of an injury to the neck. This was because, after a year's relief, intense pain again ensued along with deviation and rigidity of the neck. The pain and rigidity were not relieved by manipulation, although the patient had been completely relieved previously by manipulative treatment in the same hospital. By these psychiatrists the deviation was looked upon as a tic, and the whole situation regarded as a psychic reaction to her former accident. A factor contributing to that diagnosis was the volubility of the patient and her excitable manner.

A more thorough exploration, however, made it clear that the patient's manner reflected not lack of intellectual balance but an earnestness of character aroused by a widow's necessity to gain a livelihood for her family. She had proven herself for twenty years highly efficient in responsible clerical work, in which she was eager to continue. Whatever anxiety she showed was attributable to the wish for recovery. All the movements of the head were restricted, more particularly bending to the right. The twist of the neck had none of the characters of mental torticolis. It was merely an attitude adopted to minimize pain.

On the contrary, the tics are convulsive and intemperate in character, are accompanied by consciousness of the act, are preceded by a desire sometimes amounting to a passion to perform the act, and are followed by a feeling of relief after performance of the movement. At all events, the victim of tics feels compelled to make the movement comprising the tic; hence the term impulsion or compulsion neurosis. The movements always represent, however incompletely, some voluntary act, e. g., turning the head, wrinkling the nose, shrugging the shoulders, biting the cheek, blinking the eye, sniffing, or jerking a limb. The end to which the movement was first directed has, however, often passed from the recollection of the patient; and the act itself has often degenerated into a caricature of what it originally was. A simple example is a winking of the eyes, which has continued for years in spite of the fact that the irritation of the foreign body which first excited it has long subsided. It often originates in an idea which ultimately becomes ignored or forgotten by the patient.[1]

Although the X-ray of the neck showed no displacement of the

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[1] See "Certain Dyskinesias Irremediable by Operative or Prosthetic Measures." J. Amer. Med. Assoc., 28th Oct., 1922.

vertebrae, there could be felt a distinct thickening on the side of the spine towards which her head was turned over the transverse process of the left third cervical vertebra. Accordingly, I rejected the diagnosis of traumatic neurosis, believing that I was dealing with a trauma of the neck.

The treatment prescribed was manipulation by a skilled operator. The result was that the patient slept that night without the aid of the hypnotics she had been taking. Within a week she was completely free from pain and could move the neck in every direction. She has remained well for six months, although as a precaution manipulations are continued weekly.

Another patient much more difficult to diagnose was that of an ex-draftee sent me by the Veterans' Bureau after four years' viation from hospital to hospital because of recurrent severe pain in the lower back. After studying the case for a month the subjointed report was made; in consequence of which anchylosis was produced between the left articular processes of the fourth and fifth lumbar vertebrae. As a result it was reported that the patient is completely relieved of pain and will now be able to undertake vocational training to the profit of himself and the community.

Examination of R. G. on several occasions during the past month fails to reveal any signs of a local lesion of the spinal cord or peripheral nerves.

The test of the sensibility revealed inconsistencies in the patient's responses and a tendency to what seems like exaggeration of complaints of pain. Furthermore, in attempting Lasegue's maneuver there is no limitation of movement or spasm although the patient complains of severe pain in the back, especially when the left leg is extended; and yet with the patient lying on his side greater extension is effected without pain.

It is evident, therefore, that the patient is anxious to convince the observer that he suffers.

Whether he really does or not to the degree he complains it has not been possible to verify. Most careful X-ray studies made by Dr. Merritt reveal no certain injury; although there is an alteration of the plane between the articular processes of the fourth and fifth lumbar vertebrae on the left side, which may be regarded as a congenital difference merely, as there is no deformation or thickening of bone anywhere.

In addition to this the patient has a mild bronchitis which was acquired long after the complaint of pain in the back. He

complains also that his eyes hurt after reading without glasses.

In spite of these complaints the patient expresses himself very anxious to get well, and demurs at undertaking training which he feels himself unable to complete in his present condition.

When a fixative operation was mooted he expressed a strong wish to undertake it even after the uncertainty of the upshot was explained to him. Both Dr. Baer of Baltimore and Dr. Russell Hibbs of New York have advised me of beneficial results from fixation operation in such cases.

I am unable to give a positive opinion regarding the condition of R. G., for though there are evidences of exaggeration, if not malingering, yet there is not sufficient to impugn the man's good faith and desire to recover.

I believe that justification for a fixative operation may be possible and that the undertaking therefore should be seriously considered after due consultation with a surgeon experienced in such a procedure.

NO DIAGNOSIS BY EXCLUSION

But even when trauma has not occurred, neither psychoneurosis nor malingering should be diagnosed by exclusion. A physical state may be responsible for complaints which may seem unjustifiable to an investigator who does not seek the mechanism of his patient's derangements. For instance:

A stenographer became weaker and less able to perform her work, which rendered her more and more irritable, and she began to sleep badly mainly because of a gnawing pain in the shoulder and lower neck. Her physician detected no physical signs and treated her by the tonics unfortunately too usual. Examination discovered that the whole syndrome was really secondary to the pain in the neck and that this was due to a faulty stooping posture at the keyboard. A few exercises with attention to posture at work removed the pain, and the asthenia ceased for a period of eight years.

A most striking instance where manipulation persevered in might have led to permanent disability is one where pains in one leg were so severe as to prevent sleep without narcotics. This was followed by wasting, and the surgeon attributing this to a matastasis in the pelvis pressing upon lumbo-sacral cords opened the abdomen. Nothing was found and narcotics were continued. No neurologist was consulted until the patient in misery

consulted another physician. He, wiser, immediately sought neurological consultation. Diagnosis of a growth pressing upon the third lumbar segment of the spinal cord, and the third and fourth left lumbar roots was at once made. Within the dura mater was found a growth the size of a large bean at the level diagnosed. Nothing further was found upon the roots themselves. The growth was removed, whereupon the patient's leg pains entirely ceased. Time will be required for regrowth of the atrophied muscles. The growth proved to be a circumscribed chronic inflammatory process with hemorrhages.

THE POST SWIMMING POOL[1]

By Major JAMES C. MAGEE

Medical Corps, United States Army

THE INCREASINGLY important part that athletic games and exercises have played during the past several years in the development of the American soldier has been attended by the installation of much new equipment of a more or less important character, which constitutes, as an integral part of the post or camp material, a charge, in some degree, on the medical officer. While running tracks, tennis courts, etc., may be immune from his ministrations, certain other devices become, preeminently, subjects for consideration by agents engaged in the problem of sanitation and health preservation. This is true of gymnasiums and recreation halls provided with bathing facilities, and especially so of artificial bathing pools.

Until a few years ago, pools were unknown in the Army, save in some of the larger and more important posts. Lately, however, the demand for adequate facilities of this nature has been so insistently raised, in keeping with the cry for equipment designed for the requirements of various other forms of exercise, that the Army has been supplied with a considerable number of pools, while unquestionably more will follow. It appears true that each factor making for the increase of man's comfort or the betterment of his condition, invariably requires the exercise of effort on his part to ensure him that his new blessing will retain its beneficent qualities, instead of degenerating into a burden and menace to its user. The more things he possesses, the more causes he has for worry and for the exercise of watchfulness on his part. Our increase in knowledge of sanitary matters, while showing the road to health, at the same time demands large expenditures of time, effort and money in order that benefit may be derived from that knowledge. These observations apply with peculiar force to swimming pools. While literature teems with reference to them, their construction, management, etc., in civilian life, very little has been said on this subject so far as the Army is concerned, though the importance they may assume in relation to the health of the command must be apparent to anyone interested in the matter. We are all inclined to accept the conveniences provided for us, with seldom a thought

[1] Thesis, Graduate Course in Preventive Medicine, 1922, Army Medical School, Washington, D. C.

of any responsibility as far as we are concerned, but in the swimming pool the medical officer, at least, should find an object worthy of earnest study and unremitting care.

Swimming-pool construction is, of course, primarily an engineering problem, and with that particular aspect of the subject we shall have little to say beyond indicating the type of construction now deemed acceptable in progressive civilian communities, as compared with the rather primitive type frequently seen in the Army. It is perfectly patent that it will not always be possible to obtain, for the use of our troops, pools of the very elegant and elaborate design encountered in colleges and clubs; for these things cost money, and army appropriations are limited to such a degree that we must be content with humbler and less perfect equipment than our civilian brethren enjoy. The comparison will serve, however, to keep in mind what should be done and may enable us to copy in plan, if not in material, the very handsome structures so frequently seen in our cities.

In general terms, a modern pool is of reenforced concrete construction; or a steel tank with a concrete lining may be used, the thickness and reenforcement of the walls and bottom being based upon hydraulic stresses. This shell is water-proofed against both inward and outward percolation by one of several effective methods, it being recognized that ordinary cement and concrete work do not make a pool water-tight. A lining of highly glazed tile is applied over the entire surface of the pool and to the foot-board surrounding it. Edges and corners are preferably rounded. A very important feature of the construction is the installation of the scum gutter. The advantage of these refinements from a sanitary standpoint may be readily appreciated. The walls and bottom of such a pool are less subject to fouling and are more easily cleansed than those of inferior workmanship; while the scum gutter serves several important functions in its capacities of overflow, cuspidor, surface skimmer, and hand rail. Finally, most modern pools are equipped with refiltration and sterilizing devices suitable for the application of germicidal agents, enabling the plant to be operated at the lowest practicable cost, through the repeated utilization of the same water.

The sort of pool briefly indicated above is rarely seen in the Army, either because those now in use were constructed years ago, or because sufficient funds have not been available to build the type desired. As a consequence the problem of swimming-pool

sanitation in the Army is rather complicated and calls for the exercise of the utmost care on the part of responsible authorities. So far as circumstances will permit, it should be accepted as a principle in the service that construction of this nature in the future should be made to conform as closely as possible to the standards considered acceptable in civil life. Failing this, medical officers, recognizing the handicaps imposed on the average post pool, should make a virtue of necessity and endeavor to compensate for structural defects by added attention to sanitary principles.

The question of the possibility of the transmission of disease in swimming pools has not yet been answered in a satisfactory way. Many authors are firmly convinced that they have a distinct and important bearing on the incidence of many morbid conditions, while others are inclined to attach scant importance to such conclusions. A review of the literature indicates that a certain amount of work of more or less importance has already been done and that the findings of several investigators present very substantial evidence to the effect that, on occasions, the pool may be a potent factor in the dissemination of disease. The majority of the references on this point are merely quotations from the reports of a few original workers who proved in their own experience the culpability of swimming pools in this respect.

Mannheimer, who has written extensively on the subject, quotes many instances from medical publications to support the contention that pools may be disease transmitters. Notable among these is the account of an epidemic of vulvo-vaginitis that occurred in Posen, in which several scores of frequenters of a public bathing pool were infected through this medium. Jaeger in 1893 traced ten cases of typhoid, in soldiers in garrison, to an infected pool in the Danube, satisfying himself that this was the means of transmission in their particular cases. Similar occurrences have been reported by Pfuhl, Shafter, Klein, Maier, and others as being due to infected pools or river waters. Shiga reported 413 cases of dysentery in Japan as having been contracted while bathing, and Rice tells of 34 cases of typhoid fever occurring in English soldiers, all of whom had frequented a certain bathing pool, while among the members of the garrison who abstained from this exercise no typhoid occurred. Physical directors in gymnasiums frequently come in contact with cases of middle-ear disease and conjunctivitis, definitely traceable to the swimming pool.

The infections usually reported as seen in bathers, and pre-

sumably contracted in this way, are the common intestinal complaints, acute respiratory diseases, inflammatory conditions of the eyes, venereal disease and sore throats. Skin lesions have also been reported.

VonBuskirk, in an effort to obtain information on the epidemiology of pools throughout the country, mailed questionnaires to the health officers of all states. Thirty-six replies were received of which twenty-five were entirely negative, there being no data available on the subject. Of the remaining eleven, two states reported ear infections, three skin infections, three eye infections and one typhoid, all as having been contracted while swimming.

Significant figures on the part played in disease transmission by bathing pools in the Army are not yet available. During the summer of 1922, Lieut. Col. Charles L. Foster, M.C., instituted a preliminary survey of pools in the Eighth Corps Area, the results of which were kindly made available for the purposes of this paper. From the reports presented, it is quite impossible to attach guilt to the post pools, in so far as the evidence of disease transmission is concerned. The available figures are too small to be conclusive in either direction, but it is noted that the medical officers charged with the investigation of the matter express the belief that no case of disease in the group examined may be properly charged to this cause.

The question is still open, and the importance of the rôle played by the pools in the occurrence of infections among bathers needs further elucidation. The consensus of opinion among observers appears to be that the dangers inherent in them have been exaggerated, but that in the light of all obtainable evidence it must be admitted that many diseases may be transmitted through their use. Certainly, when we consider the prevalence in our communities of the carriers of various diseases, the probability that persons in the incubation period or actually in the early stages of transmissible ailments, and the opportunity afforded in bathing pools for almost direct contact between these persons and their healthy susceptible fellows, it cannot be denied that, on theoretical grounds at least, the pool may be a potent factor in the propagation of many disorders. Should we be disinclined to accept this view, we must be prepared to abandon many of the ideas at present held as to the importance of water from a strictly epidemiologic standpoint. Recognizing, therefore, the possible dangers of the pool, it becomes necessary that some acceptable standard of purity

be arrived at, and as rigidly lived up to as possible. Such a standard must of necessity be arbitrary, and based on common experience as to the degree of purity requisite in water. Several of our states have adopted standards that are considered acceptable and apparently work satisfactorily, but the best thought on this subject seems to be that the water must conform to the standards for drinking water, that constant dilution is required, and that disinfection is advisable.

The standard of water purity adopted by the American Public Health Association requires that gas shall develop in not more than one in five 10 c.c. portions when planted in lactose broth, after twenty-four hours incubation, with a total bacterial count not to exceed 100 per c.c. This degree of purity may be hard, or indeed impossible, to attain in the water of a swimming pool, but it is difficult to see how any deviation from these requirements may be deliberately permitted when one considers the fact that swimming water is, to all intents and purposes, drinking water. No person can swim for any length of time without swallowing a certain amount. It becomes the duty, then, of the sanitary officer to approach as closely as he may to this high standard of purity, and the accomplishment of the desired end entails the closest supervision and the most unremitting application of the knowledge at his disposal.

The pool, if untreated, soon becomes a vile thing, polluted with all manner of filth and exceedingly rich in bacteria. Many bacteriologic studies have been made in this connection, and writers are unanimous in proclaiming the unbearable conditions that rapidly arise in the absence of proper supervision—conditions that the public will not tolerate either on aesthetic or sanitary grounds. The degree of pollution, of course, bears a direct relationship to the number of bathers and the degree of efficiency manifested in the management of the pool. But, at best, untreated water becomes highly contaminated within twenty-four hours, the number of bacteria then rapidly increasing until by the end of the second or third day they are present in unbelievable quantities. While it is true that the colon count is a more reliable guide than the total bacterial count, it must be accepted in general that the latter is an excellent index of the sanitary condition of any pool. As a matter of fact, in those showing high counts, trouble is never experienced in demonstrating *Bact. coli,* often in large numbers.

Experiments conducted in Hamburg indicate that untreated pools cleanse themselves on the septic tank principle. Examina-

tions were made of freshly introduced tap water and again at varying periods after use by bathers. The results are interesting, tending to show that up to a certain number of bathers there was a very rapid increase in the total bacterial count, but that a point was soon reached at which the increase in bacteria failed to keep pace with the increase in the number of bathers, the pool apparently having reached its possible maximum of contamination.

Some very high bacterial counts have been reported from communities in various parts of the country, and the necessity for the institution of practical methods of pool control has been acutely felt. But the prize for the high score apparently must be presented to any one of several of our army pools. The degree of contamination reported in these exceeds all permissible bounds and constitutes a condition which must be considered a menace. In the data collected by Colonel Foster are figures pertaining to three pools frequented by members of our military forces and their families, which give evidence of a state of filth that is shocking to contemplate, as reference to the following abstract will show. The water in these pools receives no treatment, and all are operated on the fill and draw principle. The users are drawn from a rather select stratum, in so far as personal cleanliness is concerned.

	Lowest count col. in c.c.	*Highest count col. in c.c.*	*Bact. coli*
Pool No. 1	160	900.000	+
Pool No. 2	60	600,000	+
Pool No. 3	160	120,000	+

A glance at the foregoing is sufficient to convince one of the exceedingly high degree of contamination rapidly attained by an untreated pool. The results would be satisfactory for sewage, but certainly cannot be countenanced in water intended for bathing purposes.

The impurities introduced by bathers consist of filth collected on the feet; loose hair; particles of skin; fibers from bathing suits and hawkings from the mouth and nasal passages, which after a time settle and form the coating commonly observed on the walls and bottoms of pools. This coating is exceedingly rich in bacterial life and is in itself sufficient to produce a very rapid contamination of freshly introduced water, even in the absence of bathers. Its removal is quite difficult, especially if the lining of the pool exhibits any inequalities or roughness of the surface.

As pointed out in an earlier paragraph, there have been con-

tinuous changes in the type of construction deemed acceptable for swimming pools, with the formulation of certain definite principles now generally embraced in the modern standard. Thus the scum-gutter is designed to remove much of the pollution introduced by bathers before it has a chance to settle, and actually prevents the introduction of a large part of it by providing a cuspidor for the reception of expectorated matter which would otherwise discharge directly into the water. Then the principle of continuous flow with refiltration serves to diminish the degree of bacterial contamination very markedly by dilution. The lining of the modern pool, being highly glazed and impervious, may be cleaned with a minimum of effort; and finally, the practice of water sterilization affords protection in a large measure against infection.

It must be repeated that few pools in the Army are constructed on anything like so elaborate or satisfactory a plan as the above, and that the sanitation of such plants as we have is a very serious problem. In a later paragraph an effort will be made to outline the measures regarded as essential in their management.

Plainly, hard and fast rules cannot be laid down for all pools. Each must be very largely judged on its own merits, due regard being given to generally applicable principles. Fair, in an interesting article, presents a scheme for measuring the probable contamination of any pool, the knowledge so obtained serving in a broad way as a guide to the degree of care necessary in each particular case. He adopts Gage's term "the bathing load," which is defined as the number of bathers divided by the capacity of the pool in thousands of gallons. The daily number of bathers varies, so it has been found convenient to use a weekly rather than a daily bathing load—that is, the number of bathers per week divided by the thousands of gallons of water contained in the pool. It was formerly the practice to estimate the degree of pollution by dividing the water equally between all users of the pool, obtaining a result in gallons per individual that was always in inverse ratio to the number of bathers. Thus, if 1,000 bathers patronize a pool of 50,000 gallons capacity, a result is obtained of 50 gallons per individual; while, if there are only 500 bathers, each individual has an allowance of 100 gallons. In this case, of course, the larger the resultant figures the less the probable degree of contamination. The "bathing load," on the other hand, furnishes us with an expression of the direct proportion prevailing between the amount of water in the pool and the number of users. So, in the above

instances, the 1,000 bathers would yield a result of twenty and the 500 bathers a result of ten, these figures bearing a direct ratio to the degree of pollution.

In the same way an "Index of Contamination" has been devised, this being arrived at by dividing the number of bathers by the thousands of gallons of *disinfected* water added, the determination being based on an hourly, daily, or weekly period as desired. As an example: let us suppose the pool of 50,000 gallons capacity to have been used during a week by 1,000 bathers. As seen above, the bathing load under these conditions would be twenty. Now suppose that during the week a complete turnover of water has been made, that is, 50,000 gallons of *disinfected* water have been turned into the pool during this period. The "Index of Contamination," then, also would be twenty. But suppose only 25,000 gallons of disinfected water has been added; then we have 1,000 divided by 25 equals 40, the "Index of Contamination."

In addition to bacterial pollution, physical properties such as turbidity and color must be considered, for bathers will not be satisfied with water that is loathsome to the senses. The turbidity of any swimming pool, of course, will depend upon the character of the water introduced, plus dirt added by the bathers. A guide comparable to the "Index of Contamination" is used in reference to this point and is called the "Index of Stagnation." It represents the total number of bathers divided by the thousands of gallons of *clear* water added during a given period, and may be accepted as a rough estimate of the degree of impurity present. It is not pretended that any of the above terms, or all of them combined, tell the whole story. They present only a crude estimate of conditions, but they help, and it is just as well that they be kept in mind.

With the problem of the pollution of the pool outlined in our minds, we come to a consideration of the measures requisite to place and maintain it in a safe and satisfactory condition. These fall under three general heads: having to do with the type of construction; practices in regard to water (dilution, refiltration, disinfection); and the efficiency of the control exerted over individuals using the pool, respectively.

There are many instances of pools of the modern type equipped with refiltration and disinfection plants and properly supervised as to the preliminary treatment of patrons, etc., where the same water is used over and over again, sometimes for weeks, with per-

fect safety and satisfaction. Indeed, even more striking results have been obtained in at least one, where neither filtration nor chemical treatment is practiced, and where the water is changed only once every two weeks with an additional gradual dilution during that time equal in amount to the capacity of the pool. Bacterial counts are reported as excellent, although the actual figures are not available. This pool, however, is frequented only by wealthy men and is very closely supervised, each plunge being preceded by a full soap and water bath or a turkish bath.

With such reports from civilian pools before us, the figures for the army posts noted above become a cause for shame. It is true that the question is rather more complicated in the latter case, partly because of inferior construction, but it is certain that other factors also are largely responsible for our poor results. It is a fact that the ordinary rules of hygiene applicable in such cases have not been properly enforced and the practice of water sterilization has been neglected. The item of expense may possibly operate on occasions to prohibit the complete emptying and refilling of pools as frequently as desired, but, even assuming this to be true, it is possible to accomplish much good by the exercise of remedial measures in other directions.

Bearing in mind the difficulties peculiar to the care of such pools as one may expect to find in the Army at the present time, every possible effort must be made to meet the problem in the most practical and efficient way. The first concern of the post authorities should be to ensure obedience, on the part of bathers, to regulations designed to avoid unnecessary pollution of the water. To this end, the preliminary shower bath must be restored to a position of real importance and usefulness. Each individual should be compelled to strip and take a complete soap and water bath before the plunge.

No person with a common cold, or a discharging ear, or an infectious disease, or a transmissible skin eruption, or known to be a disease carrier, should ever be admitted.

Bathers should be encouraged to refrain from spitting in the pool; wherever possible, vessels should be provided for the reception of expectorated matter.

A suitable area surrounding the pool should be fenced off or closed in some appropriate fashion to prevent contamination of its margin by the soiled shoes of visitors.

Water should be changed daily, if possible. At appropriate

intervals, the bottom and sides of the pool should be thoroughly scraped, scrubbed and flushed.

Such additional rules as local conditions require should be promulgated and enforced.

Due attention having been given the general subjects of police and personal hygiene, it still remains to adopt some method of water disinfection. Several plans of accomplishing this have been developed to a perfectly practicable point, and each has its champions. The agents usually employed are:

1. Ultra-violet light.
2. Ozone.
3. Solutions of copper salts.
4. Chlorine in liquid form, or as calcium hypochlorite.

Of these, the first three have certain disadvantages from the army standpoint, of one character or another, that render them less suited to our needs than the fourth. Sterilization by light requires a perfectly clear water, which must be acted on in a thin film in order to obtain good results. The necessary apparatus is costly and requires expert care, while the water as finally delivered is sterile, but does not contain an active germicide. The use of ozone, when properly handled, gives excellent results, but a special plant is required, and, after all, this method holds no peculiar advantages over simpler ones that are always at hand. The copper salts are primarily excellent for the destruction of algae but do not meet with the same degree of approbation as chlorine as a general disinfectant. Furthermore, our army personnel has been accustomed for several years to the use of chlorine for the sterilization of drinking water and has confidence in it as a harmless and efficient bactericide.

In pools of the fill and draw type (as the majority of ours are), the most convenient way of applying chlorine is through the use of chlorinated lime. The amount to be added will depend largely upon the content of the hypochlorite in available chlorine and the amount of organic matter present in the water. Chlorinated lime of full strength contains about 30 per cent of available chlorine, but this is loosely combined, and it is a common experience to find the commercial article showing a smaller percentage. Organic matter and other substances in the water have the faculty of combining with chlorine, and so not all of the chemical is free for action against bacteria.

It is quite clear, then, that sufficient hypochlorite must be added to satisfy the combining power of such substances, and an excess provided to allow for the destruction of microorganisms. In order that the presence of the required excess may be assured, repeated tests of the water should be conducted after the application of the hypochlorite and the amount of free chlorine measured.

Such tests may be very simply conducted. The solution required is 0.1 per cent recrystallized ortho-tolidin in 10 per cent hydrochloric acid solution, two standards being prepared for making color comparisons. Of these, one is the color given by 0.5 p.p.m. of free chlorine, the upper limit; and the other represents the color given by 0.2 p.p.m., which is the lower limit. The ortho-tolidin required in the test may be added to the water by a medicine dropping pipette. The amount of free chlorine in the pool should equal 0.5 p.p.m., which means that a pool of 100,000 gallons requires about 2½ pounds of hypochlorite. Smaller pools require proportionately less. The free chlorine content should never be permitted to drop below 0.2 p.p.m.

The easiest method of applying bleach to the pool is to measure into a gauze bag the exact amount required, weight the bag and drag it through the water in a manner calculated to give the greatest distribution. Continue the process until all the contents of the bag have been dissolved.

During the bathing period, tests should be made at frequent intervals (one to two hours) to determine the amount of chlorine present. Whenever it falls to a point near 0.2 p.p.m., more should be added. The process need not interfere with the bathers in any way. In fact, many volunteers may be found to drag the bag around, just for the pleasure of the exercise.

The method of testing for free chlorine as advocated by Major A. Parker Hitchens, M.C., is as follows: Take a clean 4-ounce bottle similar to the one containing the standard and fill it to near the shoulder with pool water. Add, from a pipette, 15 drops (or 1 c.c.) of standard ortho-tolidin. Allow this to stand for five minutes and compare the color with that of the color standards. If the yellow color is as deep as that of the bottle labeled 0.5 p.p.m., the amount of chlorine in the pool is sufficient. If the color is as pale as that of the 0.2 p.p.m. standard, some chlorine, but not enough, is present in the pool. Additional hypochlorite should be applied, one-half pound at a time, till the desired content of 0.5 p.p.m. is reached.

The color standards should be obtainable at any Corps Area Laboratory or at the Army Medical School.

In the foregoing there is not to be found a single new fact or idea. But the object of this paper is simply to invite attention to a condition that constitutes an offense against sanitary laws and that demands correction. Certainly the measures advocated for the conduct of army pools are simple and practicable, and it is believed that, if they are earnestly applied, a very great improvement will result. It is also hoped that more attention will be accorded the strictly epidemiologic features of the pool, as conditions in the Army are such as to favor the gathering of data that may serve a very useful purpose in assigning to it a proper place in the list of agents concerned in the transmission of infectious diseases.

MEDICAL EXAMINATION OF RECRUITS[1]

By Lieutenant Colonel HARRY VANDERBILT WURDEMANN

Medical Officers' Reserve Corps, United States Army

THE MODERN *practice of medicine* consists primarily in the prevention and relief of disease or injuries, of returning the patient to his activities at the earliest moment, and of helping the unfit to combat the exigencies of environment. But a minor part of treatment consists in the giving of drugs or surgical procedures.

Military medicine is, first, the examination of the recruit before reception into the service; second, the prevention of disease and injuries by due professional supervision; third, of the treatment of the diseased and injured with view to speedy return to active duty; and last, of the elimination of those whose injuries or diseases are incurable, or who will take a long time in recovery and hence cost too much for the cure to pay for their services. First, last, and all the time, the Army is a cold-blooded business proposition with no time or opportunity for sentimental service. When a man is unfit he is useless and must be dropped from the active list.

The examination of nearly 3,000,000 men for the World War showed that even in this happy, free and well-fed America only about one-half of our young men were sufficiently healthy to stand up under the training and trials of military life, and when we consider that this young manhood makes up but one-fifth of the population, the balance of which have a much higher disease ratio, it can readily be seen that just about one-fourth of our population is in good general health and fully fitted for active life.

In the examination of the human matériel for Army service we are required to select those who are free from disease, deformities and radical defects of body and mind in order to save the expense, the training and the upkeep of troops by preliminary eradication of unfit men.

The final acceptance or rejection of recruits now rests almost entirely with the medical officer, but in certain ways line officers exercise a considerable influence in the acceptance at the recruiting station and in requesting special authority to enlist because of special qualifications. It is thus important that they should keep well informed of the desired qualifications; for a soldier lives by

[1]Delivered at regular meeting of Reserve Officers' Association, Seattle Sector, February 15, 1923.

his belly, marches on his feet, accomplishes his mission by his head, and overcomes the enemy by his brawn.

The conditions found in 1917-18 in the examination of the draft call of 8,000,000 were partly as follows:

This study involves the analysis of the defects and diseases found in about half a million men rejected by the medical examiners of local boards and of two lots of about a million each who were examined at mobilization camps during the physical examinations of the draft in 1917-18. This number constituted about four-fifths of all of the men who were physically examined, and is representative of all. The men examined were of ages 18 to 30, inclusive, but relatively a larger proportion of the male population between the ages of 21 and 30 years is included in these statistics than of those of earlier age.

The importance of a knowledge of the defects in the American population of military age is many sided. It is important from the standpoint of social and industrial life, since it gives some insight into the availability of this population for the various occupations which our social organization requires.

It has social-medical bearings, since it indicates the physical and medical status of our population in different parts of the country under different sanitary conditions and with varying opportunities of medical and surgical treatment. It has important military bearings, since it indicates the proportion of men available for military service of different kinds. It has a social-therapeutic bearing, since it indicates the size and nature of the task before those who would seek to improve by better conditions the physical and mental standing of our population. Finally, it has a biological and eugenic significance in so far as it reveals the inherent failures in man to make complete adaptation to the rapidly advancing requirements of a highly artificial civilization, in so far as it throws light upon the constitutional limitations of the various races to meet the conditions imposed by that civilization, and in so far as it throws light on the influence of military selection on the breeding stock of the next generation.

The opportunity for securing this knowledge was a unique one. The Great War made necessary the mobilization of men of military age under 30 years, and it was early recognized that a careful selection was essential of those physically and mentally fit for the severe service that they would be called upon to perform. Consequently, thousands of medical officers were secured for the purpose of such examination.

It was done in thousands of local boards and scores of camps for a period of approximately one year. Each man was examined by at least one, and usually by a number of physicians. In the case of the men who were sent to the mobilization camps usually each was examined by from four to twelve medical officers. These

physicians each rendered an independent verdict upon the man's physical or mental condition. In case a significant blemish was found, the diagnosis of the defect was recorded upon the physical examination form carried by the recruit. The records thus made were sent to the office of the Surgeon General of the Army, copied upon statistical cards, counted, and tabulated, and they form the basis of the present study.

Of the hypothetical number of 2,753,922 men who were examined to furnish the statistics discussed, there were found 468 defective men per thousand men examined. That is to say, over half of the men were found to be without any physical or mental blemish significant enough to record. In the case of some of the men two or more defects were noted, so that in the total there are 557 defects noted per thousand men. The number would have been somewhat larger except from the fact that in taking off from the records for the first million men only the major defect was utilized in the present statistics. The number 557 is important because it represents the sum of all of the ratios per thousand for the 269 defects and defect groups into which the defects found were classified.

Tuberculosis gave a rate of 30 and constituted 5.4 per cent of the defects found. Venereal diseases gave a rate of 32 and accounted for nearly 5.8 per cent of all the defects.

Of the developmental and metabolic defects the more important are: Weight below the standard requirement for military service; overweight; curvature of the spine; goiter (both simple and exophthalmic); defective chest measurement; imperfect development of the genitalia and of the palate and upper lip.

There were 73,000 men found to be below military requirements of weight, and this group constituted about 5 per cent of the defects found. Of the nervous and mental defects, mental deficiency was the most important, being noted in nearly 40,000 men, but many more than this were detected by subsequent psychological examination. Of diseases of the nose and throat, the most important was hypertrophic tonsillitis, recorded in 64,000 cases. Finally, of defects of the skin and teeth, defective and deficient teeth was the most important group, including 37,000 men.

The summary of the various groups of defects found in the American population must not pass without a word of warning. It is true that nearly half of the men examined showed a defect considered worthy of notation. It may be regarded as surprising that not more defects were detected. Probably they would have been had the examination been less expeditiously conducted. Many of the defects are obviously noteworthy only from a military standpoint. From a point of view of society it is no defect that a South Italian is under 60 inches tall, yet this constituted a defect from a military point of view. Also, many of the defects noted, like most of those of venereal disease, were not regarded as rendering a man unfit for military service. A large proportion of the mechan-

ical defects, important as they are in a man who is to be used as a part of a fighting machine, are no serious handicap in civil life. Altogether, it is clear that fully half of the defects noted are not of such a nature as to interfere seriously with the man performing services of the highest order in civil life.

The lessons of the late war showed the practical necessity of allowing some disabilities which would have previously excused the man under the older draft law, for half our population make good in civil life with the same disabilities and they may be used for selected service in times of national emergencies.

We will now take our recruit through the examination. His *age* for first enlistment must be between 18 and 35, for after that his habits of body and mind are fixed and he may have begun to deteriorate after the latter age. His *size* should be between 60 and 78 inches and his *weight* 114 pounds and upwards, in order that he may keep up with the men in marching, get fitted to stock clothes and shoes, eat the ration, and in fact be a uniform soldier. The *chest* should be freely mobile, expansion at least 1½ inches. The *abdomen* well muscled—no gastroptosis, no bay windows, no hernias or hemorrhoids. His *head* should be of a normal average shape. There should be no hideous or disgusting deformities. He *needs* his *nose* for breathing and smelling. His *eyes* must be free from disease, and he must see well enough to do his work.

He *must* hear the commands and must have a *voice*. His mouth must be clean and there must be enough teeth to chew his food. His throat must be free from sores and diseased tonsils. His *glandular* system must not be enlarged. The *scalp* should be clean, free from disease and lice. The *arms* should have mobile joints and be fairly well muscled. Absence of the forefinger and thumb of the right hand causes rejection. The *legs* must be well muscled and have good joints. *Varicose* veins cause rejection. The *feet* must require particularly careful examination, as on their "durability" depends a large part of the man's capacity for soldiering. Stinking feet make him a pariah and is a cause for rejection. Bunions and soft corns may be practically incurable within reasonable time. Ordinary corns and misshapen toes or feet may be relieved by proper pedal apparel. *Flat feet,* fallen arches, except in the negro, and sometimes even then, proscribe military service. It is usually a poor marching foot. *Slue foot, pigeon toes,* in connection with other disabilities, are a similar cause. The genitals should be properly formed and free from disease. We must have *he*

soldiers. The skin may show general diseases or contagious skin diseases as ringworm, lice. Treat all eruptions as suspicious except adolescent acne.

Character.—While a few men who are not physically fit get into the Army, there are always several in a company who are mentally or morally trouble makers, either from ingrained perversity or congenital inability to accustom themselves to their environment. The moron, too, gets by the recruiting examiners, for all of these need more than one observation in which to place them. The N.C.O. and C.O. discover them by their misdeeds and shift them over to other organizations when possible. Better it would be to have them examined by the psychiatrist or psychologist and give them the S.C.D. (Surgeon's Certificate of Disability), before they graduate out of the service with the D.D. (Dishonorable Discharge). The details of these examinations are technical, and for each of the headings briefly touched upon here many hours of lectures could be given and yet not cover the subject.

We cannot expect, except in times of national emergency, to *enlist* the most skilled and higher grades of intelligence; for the rewards of labor in the ordinary or lower walks of life are greater in a monetary sense than that of the enlisted man. By these preliminary examinations we succeed in recruiting the best bodied of our youth, those with medium intelligence, and those who have the guts to fight the enemy, some of whom may develop superior intelligence and rise from the ranks to the officer class.

AUTHORITIES CONSULTED

Ashburn, Elements Military Hygiene, 1920.

Mason, Handbook for Sanitary Troops, 1918.

W.D., S.G.O., Physical Examination of the 1st million draft recruits, 1910.

W.D., S.G.O., Defects found in drafted men, 1920.

A.R. 40-105, Standards of Physical Examination, June 30, 1921.

REPORT ON THE CLOGGING OF SEWER PIPES BY GORDIACEA

By Major A. L. PARSONS
Medical Corps, United States Army

EARLY in January, 1923, the utilities officer, at Ft. Benning, Ga., appealed to "the Surgeon" for help in ridding the sewer pipes of a certain worm which, by forming balls, tended to clog the pipe.

Investigation revealed that one pipe was involved, the worms having been found at two points only. We may consider this part of the sewerage system of the post as a "Y." The stem of the "Y" being a 10-inch pipe; the two branches being formed by pipes 8 inches in diameter. The left branch received the sewage from a few toilets in the M. T. C. area and from a large automobile wash rack. The right branch serves a great many houses in Blocks 15, 16, 40 and 42, and the wash rack at the Post Exchange Filling Station. Except for the wash racks, the system receives only discharges from toilets and bath rooms and kitchens. All water entering the sewer is from the post water supply and is sedimented, filtered through sand and chlorinated (.5 P. P. M.). This water originally is drawn from a swiftly flowing creek. No surface drainage enters the pipes. The wash racks are of cement and are raised.

The worms were first discovered in the right branch 200 feet above the fork of the "Y." Only one ball of worms was ever found here. However, at the man-hole located at the junction of the branches the balls of worms were found in quantity. This man-hole is 5 feet in diameter and holds roughly 300 gallons of sewage at all times. It is used as a sand trap. Here the worms developed so rapidly that it was necessary to remove them every forty-eight hours. Every second day from three to five balls of worms were removed, each of which was about 10 inches in diameter. The worm mass acted as a valve over the outlet pipe. How many smaller balls were washed down the pipe is not known. No obstruction occurred below the man-hole. No worms were ever found except in the balls or knots.

The individual worm is red or reddish-brown in color. It is about as large as the lead in a lead pencil and attains the length of 12 inches. When entangled in the ball or "knot" some 2 inches of each worm is projected from the mass and kept constantly in mo-

tion, giving the impression that the ball is covered with coarse fur. It was impossible to count the number of worms forming a ball, but it is believed that it amounted to several hundred. It was noted that the worms, when put into a bucket of water (post water supply), died in twenty-four hours. They were still alive thirty days after burial.

Boxes of concentrated lye were hung in the 8-inch pipes (both branches) leading to the man-hole, so that the water entering the man-hole would be well charged with lye. This procedure very materially reduced the worms but never entirely eradicated them. It became necessary to remove the balls once in two weeks only, and then but one ball was found.

The worm was identified by the Army Medical School (Major Lull), as "gordius" of the family "Gordiacea." They are known as "hair worms" and usually live in the stagnant quiet water of ponds. The name is derived from the tendency of the worm to form balls or knots suggestive of the "gordian knot." Pierce mentions several species of this worm, *Para-gordius varius* being common in America. The adult deposits eggs in the water. The larvae enter the bodies of certain insects, grasshoppers, crickets, or aquatic insect larvae, depending on the species. In the insects the larvae develop and finally mature and escape into the water. Bahr claims two intermediary hosts—the aquatic larval insect and fish.

Entrance to the human alimentary tract is obtained by swallowing the adults (Pierce) or the parasitized aquatic insect larvae (Marson-Bahr). Manson-Bahr states that thirteen cases of human infestation are recorded. The symptoms are those of intestinal disorders. No such case has been recognized at this post.

The point at which these worms gain entrance to the sewer pipe is in doubt. In the absence of known surface drainage it is suggested that access to the pipes is effected through defects in the pipe.

A CASE OF ACUTE SUPPURATIVE MENINGITIS

By Major A. T. COOPER, M.C., U.S.A.
Station Hospital, Fort Benning, Georgia

THE FOLLOWING is a case report. Diagnosis: Acute suppurative meningitis, caused by an organism resembling the Welsh bacillus, with recovery.

1. D. G. F. was admitted to the Station Hospital with the following history: The boy, aged 14, while at play December 18, 1922, was struck over the occipital region with a brick. He was temporarily knocked unconscious but subsequently went to school the same day. The following day he complained of marked headache, was feverish and had nausea and vomiting. He became comatose about 2.00 a. m. the third day and was brought to the hospital in that condition.

2. Physical examination showed the head retracted, Kernig's sign markedly positive, the patient moaning when the leg was extended. Opisthotonos was present. Over approximately the center of the occipital bone was found a lacerated wound 2 cm. in length with dirty, foul edges. Lumbar puncture was done and 45 c.c. of cloudy semi-purulent fluid withdrawn; 30 c.c. of anti-meningococcus serum was then injected by gravity. Microscopic examination of the fluid showed a cell count of 17,400 per cmm., practically all polynuclears. After a prolonged search a Gram positive bacillus resembling bacillus Welshii was found. Only a few were seen.

3. X-ray plates of the head were made and showed a depressed fracture in the occipital bone. The patient was operated on by Maj. R. G. Goldthwaite and Capt. J. S. Brummette, Medical Corps, they doing a debridement and trephining. It was found that the brain tissue beneath the occipital region was lacerated by a fragment of the inner table. The fractured area was enlarged and bone sliver removed from the brain. A skin flap was sutured over the trephined area, a rubber tissue drain inserted. Cultures were made from the brain. The following day, December 23, 1922, 30 c.c. of cloudy semi-purulent spinal fluid was removed by spinal puncture. No material change showed in the cell count. On December 24, 30 c.c. of spinal fluid, less cloudy, was removed. The patient was improved, headache not so marked and patient entirely

rational. December 25, 7 c.c. of practically normal spinal fluid was removed, patient much improved. Other treatment consisted in local dressings over the head wound and irrigation with Dakin's fluid. There was some breaking down of the tissues and slight protrusion of the brain substance. This surgical treatment was carried out entirely by Major Goldthwaite and Captain Brummette, under whose care the patient was. Other treatment consisted of Murphy drip and morphine.

4. Subsequent history: This patient made a complete recovery, the brain wound healed over and the scar, about 1 cm. by 2 cm., shows slight pulsation but no protrusion of brain substance. The following is a report by Captain Green (pathologist) of the organism isolated:

A Gram positive spore forming bacillus with capsule, apparently an obligatory anaerobe, morphologically closely resembled the Welsh bacillus. Inoculating a mouse intravenously, killing the mouse and incubating, smears from the blood and organs of the mouse showed a pure culture of this organism, with gas formation in the tissues.

A FURTHER CONTRIBUTION TO THE DISCUSSION OF ANNUAL DEATH RATES

By Major MILTON W. HALL
Medical Corps, United States Army

WHILE disliking to appear to continue a controversy unnecessarily, the implication in the recent article in the MILITARY SURGEON in "Defense of the Usual Method of Calculating Annual Death Rates," that I had cast doubt upon the accuracy of the reports of the Surgeon General, United States Army, makes it obligatory upon me to disclaim publicly any such intention. The statistics of the United States Army with respect to disease and death are as accurate as it is humanly possible to make them, and, especially as regards morbidity, are almost the only reliable figures available to the English-speaking profession.

It would appear from the balance of the article in question that the present writer had signally failed to make clear the point he was endeavoring to bring out in his paper on "A Possible Fallacy in the Calculation of Annual Death Rates," or else that his critic failed to read that article with great care. Certainly if the article contains anything that can be construed as a denial that 4 divided by 2 equals 2, or that 15,939 divided by 999.680 equals 15.94, its author is unable to discover it. However, to return to essentials it appears to the writer that his critic and himself look at the matter of an annual death rate from a somewhat different standpoint. Should one desire a rate by means of which to compute the number of deaths occurring in a command in a year, given its mean strength, the rate as customarily computed would be the only one to use. The epidemiologist and sanitarian, however, desires a rate which will give in a single figure a basis for the comparison of the force of mortality acting on different groups of population during a given time. The rate as usually calculated provides such a figure only when the population remains practically stationary. Under such conditions, as shown in the original article, the two methods of calculation produce the same result. That comparisons by means of the usual rate are unfair when strength varies greatly is admitted in my critic's article.

To apply these considerations to the examples in percentage given by my critic it is necessary to point out that the examples given are not pertinent, because they fail to take into account the

time element involved in the calculation of rates. Let us, using his figures, restate the problem in this way. A man in the conduct of his business has to borrow money during the course of three years. In 1918 he borrows $1,000 at 6 per cent, in 1919 $2,000 at 7 per cent, and in 1920 $3,000 at 8 per cent. This tabulates as follows, each loan being for the period of the calendar year:

Year	*Borrowed*	*Interest rate*	*Interest paid*
1918	$1,000	6%	$60
1919	2,000	7%	140
1920	3,000	8%	240
	$6,000		$440

Another business man (still using my critic's figures) borrows during the same years the sums shown in the following table:

Year	*Borrowed*	*Interest rate*	*Interest paid*
1918	$3.000	6%	$180
1919	2,000	7%	140
1920	1,000	8%	80
	$6,000		$400

It is perfectly evident that the first man paid more interest for his money than did the second; indeed, as has been so carefully calculated in my critic's article, he paid on the average 7.33 per cent to 6.66 per cent paid by the second man. However (and here is where the difference in point of view comes in), suppose that an economist or student of business conditions wishes to determine what is the average rate of interest charged by the banks for the three-year period 1918-1920. He has before him two sets of figures. One man's loans averaged him 7.33 per cent; the other's averaged 6.66 per cent. Which shall he take as representing the average charged by the banks? Obviously, for this, neither is the correct figure. For this he is compelled to take the average of the rates themselves, irrespective of the amount loaned. He is not, for the moment, interested in the amount borrowed by either man.

Applying this example to the matter under discussion, it is seen that the interest rates correspond to the monthly death rates as calculated from observed figures. (Weekly rates would, of course, produce still more satisfactory results.) The amounts borrowed correspond to the monthly strength of our commands. Is it not evident that the sanitarian who desires to compare the force of mortality acting upon two commands would do better to take the mean of the monthly rates rather than to rely upon the rate of

either command computed, as is customary? Is it not axiomatically true that if monthly rates remain the same in two commands throughout the year, their annual rates should also be identical? My critic admits in the last paragraph of his article that, under certain conditions, comparison is best made by means of monthly rates. Admitting that, it is difficult to understand his contention that two commands, one of which shows a consistently higher monthly rate than the other, should be given the same annual rate.

The use of monthly rates for comparison is sometimes impossible. Thus a comparison by months of the military and civil death rates from influenza during 1918 is not possible because the published figures of the Census Bureau do not give monthly figures divided into the age and sex groups necessary for the comparison. The civil population for the year, however, remains nearly constant. We know that under such circumstances the two methods of calculation produce identical results. For a comparison we desire to know the number of deaths that would have taken place in certain age groups of males in the civil population had the army rates prevailed. To obtain this number we apply the army rates month by month to the civil population and take the sum of the resultant figures or, more shortly, apply to the civil population the mean of the monthly rates for the Army. We thus avoid the false values introduced by the varying strength of the Army from month to month. We thus reduce both sets of data to the common basis of a constant population throughout the year, and comparison between the rates so deduced may be properly made. This reduction of data to the common basis of a constant population is the essential point that was so evidently not made clear in the original article. The same reasoning of course applies in the comparison of commands whose strength varies unequally.

The writer is fully aware of the necessity of using the weighted average in calculating the arithmetic mean of a frequency distribution,[1] as is so clearly brought out by his critic. It is, however, precisely to avoid the weighting due to strength increases, which have nothing whatever to do with the underlying causes of mortality, that the use of the mean monthly rate is advocated. If we think of the monthly rate not as a ratio (the purely mathematical point of view) but as a numerical expression of the force of mortality acting during the month in question (the sanitarian's view-

[1]A series of monthly death rates is not a frequency distribution.

point), it is seen that these figures may be properly combined in a simple average expressing the force of mortality for the year. What the sanitarian desires is not primarily a knowledge of how many men die in a given year, but rather a figure that reflects, in a form that permits comparison, the activity of the causes that produced those deaths. In other words, the sanitarian will find most useful a rate "which, when applied to the average strength of a command for a year, shows the same number of deaths as would have occurred in a command of equal strength, constant throughout the year, affected by the observed monthly death rates." In commands of constant strength or in the usual civil community either method of calculating the annual rate will satisfy this definition. It is precisely because, when variations in monthly strength are great, the rate as usually calculated does not give figures of comparative value (as admitted by my critic), that the use of the mean monthly rate for the year is advocated.

In conclusion the writer wishes to reiterate his denial of any intention of casting doubt upon the accuracy of the figures published in the Reports of the Surgeon General, or to reflect in any way upon those who have been responsible for their preparation. The writer believes that the adoption of the method of calculating rates here advocated would produce figures of more general value than those deduced in the accepted manner. This being so, it is no less than his duty to propose the subject matter to the profession for discussion, and he wishes to express his gratification at having elicited so prompt a response.

ASSOCIATION NOTES

THE ANNUAL MEETING FOR 1923

After due deliberation, the Executive Council, with the advice of the President of The Association, decided to hold the annual meeting of The Association at the Army Field Service School, at Carlisle Barracks, Pa., and set the date as of the 4th, 5th and 6th of October. The selection of this date will not interfere with the meeting of the American Legion at San Francisco from the 16th to the 19th of October.

The advantages of the meeting at Carlisle Barracks are as follows: It is hoped that there will be a large increase in delegates from the National Guard of the various States at this meeting and a session at Carlisle will present unique opportunity for demonstration of matters which are of particular interest to the military surgeon. It is the sense of the Executive Council that our meetings should particularly concern themselves with matters which relate to questions military. It does not seem wise to attempt to compete with the general medical gatherings throughout the country which cover so completely questions relating to either general medicine and surgery or to the various specialties therein.

By holding the meeting at Carlisle Barracks we shall have the advantage of the work of the Army School and the benefit of demonstration of various questions which affect the military surgeon in the field. Tentative program, subject to possible change, is as follows:

Oct. 4: Preliminary Meeting, Reports, Demonstration of new equipment for Medical Troops and Units.

Oct. 5: All Day Demonstration of Lines of Medical Aid from the Firing Line back to and including the Field Hospital.

Oct. 6: Final Meeting, Election of Officers, Presentation of Papers. Adjournment.

It is hoped that we may have at this session, as in the past, a good representation of foreign delegates and it seems reasonable to believe that this meeting may be even more instructive and interesting than those of recent years.

The Council is of the opinion that for the last several years the annual program has been too full and it is deemed advisable this year to eliminate the formal sessions in the evenings in order that

those who attend may have some opportunity for personal intercourse, amusement, and the making of new friendship and the renewing of old.

Carlisle Barracks is just outside the town of Carlisle, Pa., which is 19 miles from Harrisburg, readily accessible by rail from any part of the United States and in reasonably central locality.

Further notice of the meeting will be published from time to time in subsequent issues of The Military Surgeon. It is hoped that we may have a record-breaking attendance.

COMMENT AND CRITICISM

NATIONAL BOARD OF MEDICAL EXAMINERS

The following examinations are announced by the National Board of Medical Examiners: Part I, June 25, 26, 27, 1923; Part II, June 28, 29, 1923; Part I, September 24, 25, 26, 1923; Part II, September 27, 28, 1923.

All applications for these examinations must be made on or before May 15.

Further information may be obtained from the Secretary, Dr. J. S. Rodman, 1310 Medical Arts Building, Philadelphia, Pa.

SLEEPING SICKNESS

"The U. S. Public Health Service has no statistics in regard to the prevalence of *encephalitis lethargica,* popular known as sleeping sickness, that are sufficiently reliable and complete to warrant a statement as to the extent of the disease throughout the United States," says Surgeon General H. S. Cumming. "The disease is 'reportable' by physicians in comparatively few states; and in the larger part of the country the only data available are based on newspaper reports. Moreover, the disease is rather easy to confuse with some other diseases, and its prevalence is therefore likely to be unduly magnified. Thus, in an investigation made by Dr. H. F. Smith, of the Public Health Service, of the 1918-19 epidemic, 22 per cent of the supposed cases had to be excluded as being really cerebrospinal meningitis, cerebral syphilis, brain abscess, tuberculous meningitis, epilepsy, poliomyelitis, hysteria, or acute alcoholism.

"The disease appears to be only difficultly communicable. Not a single secondary case is known to have occurred in the immediate families of the patients reported in 1918-19, although some 900 persons were exposed.

"The fatality is rather high. Of the 159 cases studied by Smith death resulted in 46, or 29 per cent.

"It is interesting, though perhaps not significant, that the peak of the outbreak of 1918-19 was reached in New York City in January; in Virginia in February, and in Louisiana, Texas, and Illinois in March. In California the largest number of cases reported in any one month was in April. Whether this progress was related to the season of the year or was merely a result of the spread of

the disease is not known. Comparison with the present spread may throw some light on the subject.

"The disease is slow in development and long in duration. The period of convalescence is variable; in some cases recovery is completed within two weeks after the subsidence of the acute symptoms; but in others it is prolonged and leaves its record on the mind, on certain muscles, and on the nerves of the cranium. The mental troubles, however, usually pass off eventually.

"The appearance of encephalitis in epidemic form has, except for one epidemic reported from Austria, always been preceded by an epidemic of influenza. Forty-six per cent of the cases studied by Dr. Smith had had influenza and 54 per cent had not. The influenza-attack rate has been ascribed to the lowering of the vitality of the patients by the influenza; but has also been explained as being really due to another attack of influenza which has invaded the central nervous system of the body. Whether or no there is any connection between the two diseases has not yet been established."

THE STANDARDIZATION OF BIOLOGICAL STAINS

On March 2, at the Chemists' Club in New York City, there was held a meeting of the Executive Committee of the Commission on Standardization of Biological Stains. The members of this committee are: H. J. Conn, Geneva; F. B. Mallory, Boston; L. W. Sharp, Ithaca, N. Y.; J. A. Ambler, Washington, D. C.; and S. I. Kohnhauser, Louisville, Ky. The meeting was also attended by C. H. Herty to represent the Synthetic Organic Chemical Manufacturers Association, and by F. P. Garvan and W. F. Keohan to represent the Chemical Foundation. The meeting is a matter of interest to everyone in the medical profession.

All physicians realize the need of dyes for staining specimens in the laboratory diagnosis and investigation of disease. It is not perhaps so generally realized that the dyes used for this purpose, in order to give constant results, must be of very precise chemical composition; and yet it is a very difficult matter for either the chemist or the biologist to control their composition. Before the war all stains were imported from a single German firm. This firm did not manufacture stains, but bought textile dyes in batches of considerable size, and after some preliminary testing bottled them and sold them under its own name to the biological laboratories of the world.

When the war broke out the American laboratory was deprived of this foreign source of stains. After the pre-war stocks already on hand had given out, much difficulty was experienced in getting stains of the quality necessary. The Society of American Bacteriologists began an investigation of American-made dyes that were being sold as biological stains. The results of this investigation were so promising that it proved possible to secure the assistance of the National Research Council through whose agency a cooperative investigation was arranged among the members of several national societies. Recently the work has been organized under a special commission independent of the Research Council but still representing the different national societies that were cooperating in the earlier work.

At the executive committee meeting of this commission just held, the very encouraging results of the work were reported. It was shown that already the stains available in America are in practically all cases as good and sometimes better than the best of the pre-war stains. The most important fact brought out at this meeting was that, while the pre-war stains were standardized only in an empirical way, by buying large batches without knowing the exact composition of the dye, they must now be standardized on the basis of pure chemicals.

The reason for this is because it is proving that in some cases the impurities present in the pre-war stains were very necessary. Sometimes these impurities were other dyes and sometims supposedly inert materials like dextrin. In all such cases the task plainly before the commission is to find out what the impurity is which was responsible for the good staining qualities of the impure product. Then in the future the users of stains must demand that these impurities be present, not as impurities, but as intentionally added ingredients. When this has been done and the products are labeled and used accordingly, the American stains will become standardized in a true sense of the term.

Very shortly the commission will begin issuing certification of definite batches of stain that it has found satisfactory. These stains will be put on the market under a special label bearing the name of the commission. Users of stains must be on the lookout for products bearing this label. Buyers of stains must also watch for spurious imitations of this label put out by unreliable concerns. Any form of certification appearing on a stain label not bearing the name of the Commission is merely a certification by the manufacturer or dealer himself, and as such has no value.

The Chemical Foundation has very kindly agreed to support the work of the Commission financially.

AMERICAN PROCTOLOGIC SOCIETY

The following is the preliminary program of the twenty-fourth annual meeting of the American Proctologic Society, to be held at Los Angeles, California, June 22 and 23, 1923. Meeting place and Headquarters: Hotel Alexandria. Clinics: Los Angeles County Hospital. The profession is cordially invited to attend the public sessions:

Presidential address; Dr. Emmet H. Terrell, Richmond, Va.

1. A Plea for the Protection of Young Wives against Venereal Disease; Dr. Joseph M. Mathews, Seattle, Wash.

2. Gastroenteroptosis: Treatment; Dr. William H. Axtell, Bellingham, Wash.

3. Circular Amputation for Marked First and Second Degree Prolapse of Rectum. Lantern Slides; Dr. Frank C. Yeomans, New York, N. Y.

Case Reports: Villous Tumor, Large Papillary Adenoma, Fistula. Lantern Slides; Dr. Harold E. Dunee, Washington, D. C.

5. Pruritus of the Anus; Dr. Joseph F. Montague, New York, N. Y.

6. Hydrochloric Acid in the Treatment of Rectal Affections; Dr. Granville S. Hanes, Louisville, Ky.

7. The Ambulant Treatment of Ano-rectal Fistula; Dr. Arthur C. Crookall, Seattle, Wash.

8. Ano-rectal Operations under Local Anesthesia; Dr. Joseph F. Saphir, New York, N. Y.

9. Case Reports; Lipoma of Buttock Resembling Female Breast with Nipple. Photographs; Dr. Isaac L. Ohlman, Pittsburgh, Pa.

10. Case Report: Tuberculosis of Anus and Rectum; Dr. William M. Beach, Pittsburgh, Pa.

11. Cancer; Dr. J. Rawson Pennington, Chicago, Ill.

12. The Location of Internal Hemorrhoids and its Bearing on Treatment; Dr. Louis J. Hirschman, Detroit, Mich.

13. Rectal Discomfort Due to Extra-Rectal Pathology; Dr. Alois B. Graham, Indianapolis, Ind.

In addition to the regular papers, at convenient times during the scientific and clinical sessions there will be demonstration of instruments and operative technique and discussion of several important proctologic subjects as requested by certain Fellows.

Ralph W. Jackson,
251 *Cherry Street,*
Fall River, Mass.

UNIVERSAL GAS MASK

Development of a "universal gas mask" which is considered to have the widest application of any gas mask thus far devised, and which fills every demand that may reasonably be made on a gas mask, is announced by the Department of the Interior as the result of experimental work performed by the Bureau of Mines at its Pittsburgh, Pa., station. The department also announces the development of a "fireman's canister" which is similar to the "universal canister," but is smaller and lighter, thus making it more convenient for the use of city firemen. By the use of these types of gas masks, workers in many metallurgical and chemical plants may encounter a variety of gases and city firemen may meet almost any type of gas or vapor and do work that they could not do otherwise except at the risk of death or serious disability.

The army gas mask as developed during the war gave protection against all the poisonous gases, vapors, and smokes encountered on the field of battle. But when, after the war, army-type gas masks were advocated for use in metallurgical, chemical, and other industries where noxious gases or fumes occur, the Bureau of Mines immediately pointed out that the masks give no protection against ammonia gas used in refrigerating plants, or against carbon monoxide, a constituent of blast-furnace gas, producer gas, water gas, and coal gas. Carbon monoxide is formed by the incomplete combustion of carbonaceous matter and is a constituent of the gases from certain explosives. Recently, special gas masks having canisters containing absorbents designed for protection against ammonia or from carbon monoxide have been developed, but these afford little or no protection against other gases.

To combine efficiently in one canister the absorbents for all noxious gases is difficult because the absorbents for certain gases are best when moist, whereas an absorbent or catalyst for carbon monoxide can be used only when perfectly dry. Hence it becomes necessary to use dry absorbents for the other gases.

After an extended series of experiments by the Bureau of Mines the universal gas mask was developed. The canister contains granular absorbents, consisting of activated charcoal, for removing organic vapors; a filter of cotton wool for removing smokes, dusts, and mists; caustic soda fused on pumice stone for removing acid gases; another cotton-wool filter; fused calcium chloride for extracting water vapor that inhibits action of the next absorbent; "hopcalite," a mixture of oxides of manganese and copper with

sometimes silver and cobalt that destroys carbon monoxide; and finally silica gel for absorbing ammonia. The complete mask and harness weigh about 8½ pounds. The fireman's canister weighs about 5½ pounds and is more convenient to wear than the universal mask.

The universal and the fireman's gas masks may be worn in air containing small quantities of any noxious gas. An abundance of air is necessary, because the gas mask does not furnish the wearer with any of the oxygen necessary for life. An atmosphere in which a safety-lamp flame goes out must never be entered by a man wearing a gas mask. Oxygen breathing apparatus or air helmets only can be used in such places.

Most noxious gases may be detected by the odor or taste when they penetrate a canister, either because of its being exhausted or of its activity being insufficient to absorb a high concentration, so that one has time to escape from a dangerous atmosphere before he has breathed enough of the gas to cause injury. Carbon monoxide, however, has no taste nor odor; a man who breathes it may not be aware of its presence until he becomes greatly weakened or nauseated; he may lose consciousness without rceiving any warning. Bcause of the danger from using an exhausted canister, a limit of six hours' use is put upon the universal and four hours' on the fireman's canisters.

In cool or cold weather the canisters should be worn under a coat because, when warm, they are more active against carbon monoxide than when they are cold.

Masks of the universal type are useful for emergency purposes around chemical plants or the like in which many different gases or vapors may be met. They are especially adapted to the work of city fire fighters, who encounter all kinds of poisonous gases. However, gas masks should not be used in mines for rescue and recovery purposes after explosions, because at such times the mine atmosphere is apt to lack oxygen. Self-contained oxygen breathing apparatus which carry supplies of compressed oxygen are needed for mine rescue work. When the atmosphere contains enough oxygen to support a lamp flame the universal or the fireman's gas mask will give protection against most gaseous hazards.

Tests of the universal gas mask in actual service have totaled fourteen hours without signs of failure. The arbitrary life of six hours has, however, been adopted because of the inability of a wearer to detect penetration of carbon monoxide; penetration of

other gases may be detected by taste or smell. A canister fails gradually, so that the wearer has time to escape from a dangerous atmosphere before the concentration of gas breathed becomes hazardous. The fireman's mask has a shorter life than the universal mask—four hours as compared with six hours. Both figures allow a large factor of safety.

Details regarding these gas masks are given in Technical Paper 300, by S. H. Katz, J. J. Bloomfield, and A. C. Fielder, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

STREAM POLLUTION INDEX

Some years ago it was freely asserted that the degree of pollution in a stream was indicated by the presence or absence of this or that species of "plankton," a name applied collectively to the minute free-floating plant and animal organisms that live in practically all natural waters, says the U. S. Public Health Service. It was held that some species inhabited only grossly polluted, others only moderately polluted, and still others only clean waters. From this it was argued that the degree of pollution in a stream at any point might be inferred from the species that infested the water in much the same way that, if a given stream contains considerable numbers of trout, the water is known to be essentially clean, for otherwise the trout would not be there; whereas, if *carp* be present, and trout *absent,* the essential purity of the water is questionable, and calls for investigation.

While the above principles are well founded, and have never been disproved, it is nevertheless true that certain other factors must be considered. Just as trout might be absent from a stream because fishermen were too active, or perhaps because some tannery or sawmill dumped its waste into it, so certain microscopic organisms (plankton) might be absent because of too many enemies, or because they were driven out by tannery waste or mine drainage in the stream. The task of establishing a stream pollution index by a study of the plankton must allow due weight to these and to numerous other possible factors which can be ascertained only by prolonged and careful study of the water concerned.

The U. S. Public Health Service, in a bulletin just issued on the self-purification of the Ohio River, says that the next problems that await solution by sanitarians are the determination (1) of the

relations between plankton and the pollution of stream waters; (2) of the correlations between this fact and other known stream factors; and (3) of the manner in which all these and other factors work together in self-purification of water.

These problems will, of course, be difficult to work out, for plankton are subjected to many hazards.

As they are carried down stream by the flowing water, says the bulletin, they increase and decrease in accordance with changes in the depth, velocity, and turbidity of the stream; changes in the temperature and amount of sunlight and organic matter brought by natural drainage and city sewers; and changes that result from the increase and decrease of other sorts of plankton that form their chief food.

The acid waters of a tributary mean death to many of the plankton in the main stream; the sewage from a great city means a huge increase in food and in those plankton that thrive on grossly polluted waters and a decrease in those that are suited to cleaner waters. Farther down stream, after the sewage has mostly been devoured, the stronger types of plankton eat the weaker and are themselves eaten by those that are still stronger.

Sluggish water, due to riffles, bars, islands, etc., give most plankton a chance to multiply; flood waters interfere with their feeding and bury them under sand and mud. Cold lessens their increase; and warm weather augments it. Turbidity kills and sunlight helps.

Pollution, in brief, is shown by the bulletin to be only one of the factors that control the numbers and kinds of plankton; and that before any deduction can be drawn from their presence or absence at a particular spot, it is necessary to know, for instance, whether the water there is quiet, whether the weather has recently been sunny, whether any freshets have occurred, whether industrial acids could have entered the river, etc., or whether the converse is true. These factors vary with each river, with nearly every place on each, and with weather and other conditions. Nevertheless the problems can and some day will be worked out.

BOOK REVIEWS

TEXTBOOK OF OPHTHALMOLOGY, by Hofrat Ernst Fuchs, Former Professor of Ophthalmology in the University of Vienna. Authorized Translation from the Twelfth German Edition; completely revised and reset, with numerous additions specially supplied by the author and otherwise much enlarged, by Alexander Duane, M.D., Surgeon Emeritus, Knapp Memorial Hospital, New York. With 450 illustrations. Seventh edition revised and reset; 997 pp. Price, $9. Philadelphia and London: J. B. Lippincott Company.

The book has been entirely rewritten and rearranged, the attempt having been made to follow a logical order and bring into relation the separate parts of the subject.

In the textual changes the translator has had the benefit of consultation with Dr. Fuchs and has also made comparison with the recently revised 13th German edition as edited by Professor Salzman.

Changes are found practically on every page. The sections on the anatomy of the eye are now grouped together and form the united part of the book. Following this the sections on the development and physiology of the eye, which also have received additions and changes.

The subject of refraction has been enlarged and remodeled, while many important changes have been made in the sections on mobility, light sense, color sense, perimetry and functional and objective examination.

There is a fuller discussion on heredity. Von der Hoev's theory of the origin of cataract and of senile macular degeneration, of heat, radio therapy, massage and hypertonic solutions, notions of the wave theory of light, the theory of prisms, the composition of lenses from prisms and the laws governing the formation of images. The perimetry of glaucoma is given special attention.

There is also considerable revision and additions to the section treating of the methods of objective examination including paragraphs on the slit lamp, contact illumination and examination with red free light.

Extensive changes have been made in the articles on trachoma, inclusion conjunctivitis ulcerative keratitis, ulcus serpens, pannus degenerations, corneal and scleral ectasial, anomalies of the anterior chamber and of the vitreous, the classification of iritis, the varieties of choroiditis and retinitis, the theory and treatment of glaucoma, and the subject of treatment everywhere enlarged.

That part dealing with operations has also been enlarged and revised. Among the specific additions are Francis' methods of removing superficial tumors, Wheeler's operation for a new socket and for blephoroplasty, a variety of the newer operations on the cornea, indications for operations for glaucoma and a fuller discussion of the various substitutes for enucleation.

There are chapters on the following subjects:

Protective Organs (Adnexa) of the Eye.
Cornea-Sclera.
The Interior Refractive Media.
The Uveal Tract.
Sensory Apparatus.
The Orbit and its Contents.
Development of the Eye.
General Physiology of the Eye.
General Etiology of Eye Diseases.
Symptomatology of Eye Diseases.

General Therapeutics of the Eye.
The Theory of Glasses.
General Optical Properties of the Eye.
Etiology and Symptoms of Refractive Errors.
Detection and Treatment of Refractive Errors.
Sensation and its Disturbances; Subjective Examination of Eyes.
Motor Anomalies of the Eye.
Objective Examination of the Eye.
Diseases of the Lids.
Diseases of the Conjunctiva.
Diseases of the Lacrimal Organs.
Diseases of the Cornea.
Diseases of the Sclera.
Diseases of the Interior Refracting Media.
Diseases of the Iris and Ciliary Body.
Diseases of the Chorioid.
Diseases of the Retina.
Diseases of the Optic Nerve.
Glaucoma.
Injuries of the Eye.
Diseases of the Orbit.
Eye Operations in General.
Operations on the Conjunctiva and Lacrimal Organs.
Operations on the Lids.
Operations on the Cornea and Region of Anterior Chamber.
Operations on Lens and Vitreous Chamber.
Operations upon Ocular Muscles and Orbit.

It is gratifying that this standard textbook has been brought up to date and rearranged so that it is homogeneous and consecutive.

T. E. Oertel.

Orthopedic Surgery, by Sir Robert Jones, K.B.E., C.B., Ch.M. Liverpool, R.C.S. England, Ireland, and Edinburgh, F.A.C.S. (U. S. A.), Director of Orthopedic Surgery, St. Thomas's Hospital; Lecturer on Orthopedic Surgery, Liverpool University; Member of the International Surgical Society; Member of American, Italian, French, and British Orthopedic Associations; Member of the Swedish Society of Physicians; Honorary Member of the French Society of Surgeons; and Robert W. Lovett, M.D., F.A.C.S., John B. and Buckminster Brown Professor of Orthopedic Surgery in Harvard University, Member of the International Surgical Society, Member of British, Italian, French and American Orthopedic Associations, Member of the Swedish Society of Physicians. Illustrated by 712 engravings. 8°, 699 pp. New York: Wm. Wood & Co., 1923.

An Anglo-American first edition on orthopedic surgery. Likewise one of the first books issued in 1923. The authors hold the term "orthopedic surgery" to be unsatisfactory, but have decided to retain it as a title, nevertheless, because of their confessed inability to find a better, and because it has so definitely established itself in medical terminology that an uprooting process would be difficult. The authors look upon so-called orthopedic surgery as neither more nor less than a special department of general surgery, and are of the opinion that "the principles governing the diagnosis and treatment of these (orthopedic) conditions should be those, and only those, embodied in general surgery." The subjects treated in the order of their appearance are as follows:

1. Anatomy, Physiology and General Pathology of Joints.
2. Traumatic Affections of Joints.
3. Disabilities of the Knee-joint.
4. Traumatic Affections of the Ankle, Shoulder, Elbow, and Wrist.

5. Stiffness of the Joints—Adhesion and Ankylosis.
6. Tuberculosis of Joints.
7. Tuberculosis of the Hip.
8. Tuberculosis of the Knee-joint.
9. Tuberculosis of Ankle, Shoulder, Elbow, Wrist, and Sacroiliac Joints.
10. Tuberculosis of the Spine.
11. Arthritis Deformans.
12. The Pyogenic Infections of Joints.
13. Syphilis of the Bones and Joints.
14. Other Affections of the Joints.
15. Affections of the Bones and Joints of the Spine and Thorax.
16. Developmental Diseases of Bone.
17. Affections of Adult Bone.
18. Malunited Fractures.
19. Disturbances of the Neuromuscular Mechanism.
20. Spastic Paralysis.
21. Lesions of the Lower Neuron (Spinal and Motor Centers).
22. Muscle Training.
23. Obstetrical Paralysis.
24. Lesions Involving Locomotion.
25. Congenital Deformities.
26. Torticollis—Congenital Elevation of the Scapula—Cervical Ribs.
27. Congenital Dislocation of the Hip and Other Joints.
28. Club Foot.
29. Static Deformities of the Feet.
30. Lateral Curvature of the Spine.
31. Principles of Apparatus.

Concerning the physical characteristics of the book, no more need be said than that in the matter of binding, quality of paper and typography, it is entirely on a par with all the other scientific productions of its publishers.

The present-day author who fails to recognize the value—even the necessity—of abundant illustration in medical textbooks is rare indeed. The two gentlemen whose labors have produced this work are not exceptions to the rule. The title page states that there are 712 engravings, and a rapid turning of the pages affords no stimulus to dispute this statement. Of the illustrations a very considerable majority are reproductions of photographs or roentgenograms, while schematic diagrams are used to illustrate facts and principles where photographs would not be possible or would serve no better purpose.

This new contribution to surgical literature will without doubt take its place in the very front rank of all treatises on orthopedic surgery.

A. N. Tasker.

Kirkes' Handbook of Physiology, Revised and Rewritten by Charles Wilson Greene, A.M., Ph.D., Professor of Physiology and Pharmacology, University of Missouri. Tenth American Revision, with 524 illustrations, including many in colors. 8°, 820 pp. New York: Wm. Wood & Co., 1922.

Ten American editions of an English textbook on one of the medical sciences indicate the favor which Kirkes' Handbook of Physiology has enjoyed in the United States for many years past. It has been always recognized that the succeeding editions of both the English and American versions have not failed to keep pace with the advances in physiology and so to classify and present them as to make them most readily available and most easily comprehensible to medical students and physicians at large.

One of the most notable illustrations of this principle to be found in the present edition is the discussion of those supplementary food substances known as "vitamines." Thus, in a few lines there are outlined the requirements of the human body in the matter of

vitamines. A short discussion of the specific avitaminoses—that is, xerophthalmia, ber beri, and scurvy—shows that these are definitely attributable to "lack of corresponding specific vitamines in the diet, namely, fat soluble A, water soluble B, and water soluble C vitamines." Succeeding paragraphs describe somewhat more in detail the relation between beri beri and the antineuritic vitamine B, between scurvy and the antiscorbutic vitamine C, and between xerophthalmia and the growth-producing and antirachitic vitamine A.

A paragraph is given to those studies of Koch and Voegtlin in which they compare the chemical changes that have taken place in the central nervous systems of human individuals dead of pellagra with those found in the nervous systems of monkeys fed on inadequate diets. "The resultant loss of lipoids, a tendency to a decrease in the proportion of proteins, an increase in the water content, a decrease in the cerebrosides, phosphatides and sulphatides, with a relative decrease of cholesterol in the cerebrum and an increase in the spinal cord, an increase in extractives, especially in the nitrogenous extractives," found in the monkeys very closely parallel the cerebrospinal pathology of pellagra.

The principal sources of antineuritic and antiscorbutic vitamines, as well as food substances which are relatively poor in these elements, are shown in the following table:

Table Showing the Relative Richness in Antineuritic and Antiscorbutic Vitamines from Common Food Sources. (From Voegtlin)

Antineuritic properties		Antiscorbutic properties	
Relatively rich	Relatively poor	Relatively rich	Relatively poor
Brewers' yeast	Sterilized milk	Fresh vegetables	Dried vegetables
Egg yolk	Sterilized meat	Fresh fruit	Dried fruit
Ox heart	Cabbage	Raw milk	Sterilized milk
Milk (fresh)	Turnips	Raw meat	Canned meat
Beef and other meats	Carrots and other vegetables of this type	Cereals, sprouting	Dried cereals
Fish	Highly milled cereals		Pork fat
Beans	Starch		Starch
Peas	Molasses		Molasses
Oats	Corn syrup		Corn syrup
Barley			
Wheat			
Corn			
Other cereals			

Again, the subject of internal secretions has been brought right up to the minute. The work of Banting and Best, in which they demonstrated the "isolation and function of an active internal secretion from the pancreas," is reported in considerable detail, and the results of the earlier tentative treatment of human diabetes by this pancreatic extract are noted.

The "up-to-dateness" of the whole book is of a piece with the examples just now described. This textbook holds a secure position in American medicine, and there is no ground for fear that the tenth edition will see any diminution in the strength of its entrenchment.

A. N. Tasker.

An Introduction to the Practice of Preventive Medicine, by J. G. Fitzgerald, M.D., F.R.S.C., Professor of Hygiene and Preventive Medicine, and Director, Connaught Antitoxin Laboratories, University of Toronto. Assisted by Peter Gillespie, M.Sc., C.E., M.E.I.C., Professor of Applied Mechanics, University of Toronto; and H. M. Lancaster, B.A.Sc., Director of Division of Laboratories, Provincial Board of Health, Ontario, and Demonstrator in Sanitary Chemistry, Department of Hygiene and Preventive Medicine, University of Toronto. And Chapters by Andrew Hunter, M.S., M.B., F.R.C.S.; J. G. Cunningham, B.A., M.B., D.P.H.; and R. M. Hutton, with appendix articles by various contributors. 8°, 826 pp. St. Louis: C. V. Mosby Company, 1922. Price, $7.50.

Dr. Fitzgerald and his assistants have produced a volume of great value to the student of preventive medicine, and a complete discussion of the subject is given within a short space. The authors' aims are set forth in the introduction. He believes that the state should provide an adequate health supervision for those desiring it—but no compulsion. Every physician should be a potential health supervisor and should receive the cooperation of the public. In a series of a dozen statistical tables of the causes of death he shows that conservatively estimated 29 per cent of the deaths from all causes are preventable.

In chapters 2 to 6 there are considered the communicable diseases transmitted by the secretions of the respiratory tract: Diphtheria, septic sore throat, Vincent's angina, scarlet fever, measles, rubeola, mumps, whooping cough, tuberculosis, pneumonia, influenza, broncho-pneumonia, common colds, cerebrospinal meningitis, anterior polyomyelitis, epidemic encephalitis, to which the author has added a section on trachoma. These diseases are discussed in turn as to their etiology, incidence, modes of transmission, and methods of control, an extensive use being made of statistical data and graphs.

Chapter 7 contains a discussion of communicable diseases transmitted by the contamination of food and water with certain species of bacteria. Considered here are typhoid fever, paratyphoid fever, bacillary dysentery and amoebic dysentery, diarrhea and enteritis in infants, cholera and hookworm disease.

Chapter 8 considers the insect-borne diseases, malaria, yellow fever, typhus fever, Rocky Mountain spotted fever, plague, dengue, filariasis, trypanosomiasis, and relapsing fever. Leprosy is also discussed in this chapter.

Chapter 9 deals with diseases of unknown etiology, for the more important of which there exist specific methods of prevention—smallpox, rabies and chicken pox. Venereal diseases are considered in the 10th chapter and in the 11th a miscellaneous group of communicable diseases, tetanus, anthrax, and gas gangrene, caused by germs, the habitat of which is the intestinal tract of mammals and the soil, transmitted to human beings through breaks in the continuity of the integument. Glanders and erysipelas are discussed in the same chapter.

Chapter 13 is a comprehensive discussion of the public health aspects of water by Mr. Lancaster, in which he gives directions for the sampling of

a water supply and the examination of the samples taken. The temperature, color, turbidity, taste and odors of the water are discussed and laboratory methods for the determination of the total solids, chlorides, oxygen consumed, ammonia nitrogen, albuminoid ammonia, nitrites, hardness, iron, manganese, zinc, lead are given in detail. Bacteriological examination is explained. The important subject of the nitrogen cycle is covered very satisfactorily. The second half of the chapter is devoted to water purification, the effects of storage, slow sand filtration, mechanical filtration, the coagulation of colloids and disinfection of water by means of heat, filters, chlorination, electric processes, chloramine, ozone, and ultra-violet rays.

Chapter 14, also by Mr. Lancaster, discusses the public health aspect of milk together with the laboratory methods of examination and the data required to be noted when making a sanitary survey of a dairy or milk distributing plant. Chapter 15, by the same author, discusses foods from the public health standpoint with consideration of food adulteration, methods of preservation, coloring, poisonous products derived from the containers or from decomposition. Food poisoning as produced by the salmonella group, and botulism are discussed in detail. There is also a paragraph on meat inspection.

Chapter 16, by Hunter, is "Diet, dietary defects, and deficiency diseases." The subjects discussed are: "The food requirements of man," "The requirement of energy," "The requirement of minerals" and "The requirement of vitamines." The second section deals with the effects of deficiencies in these various elements—protein deficiency with the consequent retardation of growth in the young or actual protoplasmic wastage and emaciation in the adult; deficiency of mineral constituents, calcium and phosphorus with resulting bone changes, iron with the reduction in the synthesis of hemoglobin, and iodine with diseases associated with thyroid gland; deficiency of vitamines of the three groups, fat soluble A, water soluble B, and the antineuritic vitamine with the production of such deficiency disease as xerophthalmia, scurvy, beri beri, with the possible addition of pellagra and rickets.

In Chapter 17 Mr. Gillespie discusses domestic and community sanitation, consideration of the various articles of plumbing, drainage and sewage disposal. Under the last heading there are discussed screens and screening sedimentation, irrigation of land, intermittent sand filtration, the septic tank, contact beds, trickling filters, activated sludge, chemical precipitation, and disinfection. Disposal of city refuse is likewise considered. The second section deals with community water supply in which there are discussed the sources of water, methods of storage and distribution, and finally a further discussion of water purification and softening.

Chapter 18 includes maternity and infant mortality and maternal, infant and child hygiene. Here, as elsewhere, there is an extremely effective use of statistical tables and graphic methods of presentation of the subject. Chapter 19 is concerned with school hygiene, health supervision of children of school age, including medical, dental and nursing service. The value of the use of charts and diagrams in the instruction of children is stressed, and there is given the National Child Health Council's recommendation for

pre-natal care, care at birth, infant and pre-school care, care of children in school and children in industries.

Chapter 20 is devoted to public health clinics, health centers, rural hygiene and public health.

In Chapter 21 Lancaster discusses air and ventilation, importance of the various constituents of the air and effects of reduction and increase of each of them, barometric pressure, temperature, humidity, dust, injurious gases and the general effects of overcrowding.

Chapter 22, by Cunningham and Hutton, covers industrial hygiene, accident prevention, lighting, etc., as related to industrial hygiene. The dangerous trades are considered in turn and the injurious effects of fatigue stressed.

Chapter 23 deals with demography and vital statistics in which the most elementary information is given. Chapters 24 and 25 discuss Public Health organization, administration and legislation, the importance of domestic and foreign quarantine, the health organizations in the United States and Canada, public health education and voluntary health-promoting agencies.

Not the least valuable features of the book are the appendices on industrial hygiene, employment of children, physical examination, the industrial nurse, workmen compensation acts, housing, conduct of public health centers, hygiene centers, school health service and the diagnosis and treatment of venereal disease under public health direction.

The work is a valuable one and timely, and, on the whole, the arrangement is satisfactory. However, in the first few chapters it probably would have been better had the discussion of trachoma not been included in the chapter on certain respiratory diseases and hookworm not placed in the chapter on communicable diseases transmitted by contamination of food and water with certain bacteria. Leprosy can hardly be considered as proven to be insect borne and there is doubt as to our having a specific method of the prevention of chicken pox. In the discussion of smallpox the author does not mention alastrim, which has of late given rise to much discussion. The chapters by Lancaster on water, milk and foods are excellent, and much valuable information is contained in a small space. This author's statement at the end of the article on botulism to the effect that recent experiments on development of a satisfactory antitoxin for treatment and prevention of botulism have not proven successful is not borne out by accepted experiments. In the laboratory, at least, antitoxin does prevent botulism, and it is believed that, if the supply can be made as available as that of tetanus antitoxin, equally satisfactory results may be expected. The chapter on vital statistics is very brief and, in fact, does little more than define the terms used. The greater part of the chapter is devoted to the reporting of vital statistics data and certain regulations in regard thereto. No attempt is made to explain the methods used by the vital statistician in determining the various rates, etc. The chapter on public health organism and the several appendices, dealing as they do with the various legislative measures, blank forms and their usage, should be of great value to health officers.

The author has in this work made it clear that a steady advance in medical science, together with improvement in living conditions, has

produced amazing and most satisfactory results. The expectation of life has been extended and many diseases have almost disappeared. Even groups of tropical diseases which have until comparatively recently been most deadly are coming more and more under control. Yet amid these improvements we are almost helpless to combat such diseases as influenza, measles, etc., which sweep through communities all but unchecked. That the first duty of medicine is not to cure disease but to prevent it is universally accepted nowadays, and ever bearing this in mind, the practitioner of preventive medicine must apply himself to increase the resistance of the individual and the community and to remove the cause of disease.

Edgar Erskine Hume.

Précis de Parasitologie, by E. Brumpt, Membre de l'Académie de Médecine, Professeur à la Faculté de Médecine de Paris, Secrétaire général de l'Institut de Médecine coloniale, Ancien Professeur de Parasitologie à la Faculté de Médecine de Sao Paulo (Bresil). Troisième Édition, entièrement remaniée avec 736 figures dont 302 originales dans le texte et 5 planches hors text en couleur ou en noir. 8°, 1,216 pp. Paris: Masson et Cie, 1922.

This latest edition of Brumpt's Précis de parasitologie is shown by comparison with the preceding edition to be practically a new book, many changes both in the matter of text and illustration having made their appearance.

The general plan upon which the work is based remains essentially as before—that is to say it comprises (*a*) a morphological study, (*b*) a biological study, (*c*) a study of the pathogenic rôle of various parasites, and (*d*) methods for controlling and destroying the parasites. The investigation of the morphology aims to familiarize the student so thoroughly with the genera and species studied as to make him able to identify them and classify them according to the rules of zoological nomenclature. From a biological standpoint, the elements of habitat, of nutritional and relational functions, of tropisms, the methods of reproduction, the modalities of evolution, and, finally, the influence exerted by their surroundings are so investigated as not only to impart information concerning their present geographical distribution, but as well to give a basis for prophecy as to their future dissemination. In the matter of pathogenicity, one finds full discussion of the general and special conditions which favor their gaining access to the human organism, their portals of entry, and the symptomatology and pathology of the morbid conditions to which they give rise. The methods of control are carefully outlined. Finally, certain sections are devoted to the diagnosis and treatment of parasitic infestations, and their prevention.

This work has come to exceed by a considerable measure the limits of what the French refer to as a "Précis." It has been prepared not only for students of medicine, who will be able to secure from it the elementary precepts which they so urgently need at the time of examination and the practical knowledge of which they must make application in the laboratory, but likewise, thanks to its most excellent typographical arrangement, the author has been able to include a great mass of details that make his book a very complete treatise, recourse to which should make it possible for physicians of all climates, temperate or tropical, to solve those many difficulties of diagnosis with which the parasitic diseases confront and so often confound them.

The illustrations number 736, no mean number. Many of these are new. A very detailed alphabetical index (comprising 34 pages) affords rapid and easy reference to the individual subjects treated of in the text.

This book remains as it has been in previous editions one of the most, if not the most, authoritative work upon the general subject.

A. N. Tasker.

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THE MILITARY SURGEON

VOL. LII JUNE, 1923 NUMBER 6

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

THE STATICS OF THE HUMAN ARCH WHEN SUBJECTED TO BODY WEIGHT[1]

BY HALBERT L. DUNN, M.D., M.A.
First Lieutenant, Medical Reserve Corps, United States Army

(With seventeen illustrations)

INTRODUCTION

THE ARCH of the foot has long been a subject of medical interest. Many investigators have studied the foot particularly from the standpoint of mechanics, to discover whether the arch is a structural unit and to determine how it distributes the loads to which it is subjected. Many surmises have been made as to the type of arch and its functions. Tubby ('12) believes that one should consider the foot as forming half a dome, the astragalus acting not as a keystone but as a reenforcing girder bridging two oblique piers. Jones ('17), on the other hand, believes that the "so-called arches" of the foot are not true arches at all—that there are no piers or keystones; but that the maintenance foot is entirely dependent upon the tone of its muscles and the strength of its ligaments. Between these two extreme conceptions is a host of ideas concerning the mechanical structure of the arch. Most authors are agreed, however, that there are two arches in the foot, a median longitudinal and an anterior or transverse. Anatomically the presence of these two arches is obvious, but their functional existence has been repeatedly questioned.

Although there have been a great many contributions published on the growth, shape and form of the foot as well as on the reactions of the various types of arches, especially the broken arch, there has been comparatively little quantitative work on the functional activity of the arch. Rogers ('19) concluded that the leverage of the arch was of the

[1]Contribution from the Department of Anatomy, University of Minnesota, and the Medical Reserve Corps, Fort Snelling, Minnesota.

first order, the ankle joint acting as a fulcrum. Weindenreich ('21), in a comprehensive comparative anatomical study, believed that the longitudinal arch was an actual functioning unit. Bossi ('08) experimented with the skeleton foot and observed changes in the arch with each change of weight. He concluded that the rotation of the calcaneum under weight was the anatomical factor responsible for the lengthening of the arch and the typical pathologic changes. Belvoe ('17) X-rayed the flat feet of three individuals. He then measured the descent of various fixed bony points with and without loads. His cases were too few, however, to throw much light upon the mechanism of the flat foot. Richardson ('08) also X-rayed three cases of flat feet and measured them, with practically negative results. Baisch ('13), in a radiographic study of both normal and abnormal feet subjected to body weight, observed that in the normal foot subjected to weight bearing there occurred a coaptation of the various tarsal and metatarsal bones while in the flat foot there was a separation of these bones. He claimed to be able to diagnose flat foot by this means. Cramer ('13) studied 118 cases of flat foot by X-ray and observed a chronic deforming arthritis of the bones of the tarsus, the chief deformity being located in the neck of the astragalus.

Hoffmann ('07) made a statistical study of the relation between the height of the longitudinal arch and the functions of the foot. He found that the height and the shape of the longitudinal arch were of no value in estimating the strength and the usefulness of the feet. By grouping his cases into high, moderate, somewhat low, very low, and absent arch heights, he came to the conclusion that normal feet presented high, medium and low arches in nearly the same proportion as did the feet with weakened arches. The weakness of the longitudinal arch, in fact, rarely resulted in its depression, according to his observations. He believed, therefore, that it was a mistake to consider foot impressions as an aid in the diagnosis of the weak arch and that symptoms of foot weakness resulted because the arch yielded and not merely because it was normally low. Williams ('09) also concluded that arch symptoms were not related to the height of the longitudinal arch. In his series of 300 cases, 39 per cent had anatomically low arches, 51 per cent medium, 8 per cent high, and 2 per cent pathologically high. Weed ('12) also appreciated the fact that low arches are not necessarily pathologic and that visual examination would not reveal the functional potentiality of a given foot. He pointed out the important fact that a lowered and weakened arch does not necessarily mean a painful arch although there is usually a history of pain at some time.

Feiss ('10) studied the reactions of the arch of the foot when sub-

jected to body weight. He measured the height from the tubercle of the navicular or scaphoid bone because this point changed position when the foot supported the body weight. To measure the depression of the arch under weight, he used a measurement afterwards employed by Heiner ('11) and described by following investigators as "Heiner's line." This line was obtained by placing a ruler on two easily located bony points, (*a*) the lower tubercle of the head of the first metatarsal, and (*b*) the posterior inferior corner of the internal malleolus. From this line a perpendicular was erected which passed through the tubercle of the navicular bone. Feiss found in a group of 100 cases that this perpendicular line varied in length from 0, in two cases, to 1 inch, in three cases. He concluded, therefore, that there was a large normal variation and that the physiological increase in the length of this perpendicular line when the foot was subjected to the body weight represented merely a prototype of the anatomical variation of a foot not supporting the body weight. He defines flat foot, therefore, as the position of the bones, resembling that of the bones of the arch in physiologic weight bearing, which does not disappear when the body weight is removed. He estimated the amount of flattening by the ratio of the lowering of the navicular tubercle. Elmore ('13) recommended the use of the "Heiner's line" as a means of determining flat feet for navy recruits.

Holcomb ('13) demonstrated from statistics of the Surgeon General's Office that the enlistments of colored troops showed a far higher percentage of rejections due to flat feet than did the white enlistments. For the period of seven years, 1905–1911, the rejections of the white recruits from this cause averaged about 3.5 per cent and of the colored 5.8 per cent. Obviously the negroes, having normally a lower arch than the whites, were rejected because of a mistake in diagnosis. Mebane ('18) reported the examination of 2,000 negroes; 40 per cent had flat feet in the sense that the tubercle of the scaphoid (navicular) was lower than normal. Most of these cases only appeared flat because of the plantar fat pads and the well-developed foot muscles. Anderson ('16), Muskat ('09), Schüman ('06) and Bradford and Lovett advocated new methods by which the study of the arch can be facilitated. Codman ('11), Merill ('16), Smith ('18), Harris ('14), Ogilvy ('05) and Quenu and Kuss ('11) dealt with the mechanics of the pathologic arch in a more general way.

The following study was undertaken primarily with two objects, (*a*) to obtain knowledge of the arch as a structural unit and a conception of its function in the distribution of the weight placed upon it, and (*b*) to demonstrate some of the essential differences between the

normal and the broken arch. The author expresses his indebtedness and gratitude for the valuable suggestions and facilities placed at his disposal by Dr. R. E. Scammon and Lieut. Col. H. H. Rutherford.

MATERIAL

The data obtained for this study were secured from several sources. The feet of 109 individuals were studied, 108 males and 1 female. The 109 individuals were separated into five groups. The first group consisted of 30 college students, 29 having normal feet, and one a moderately pathologic arch which had troubled him for about a year. The second group was made up of 50 soldiers, of whom 38 had no symptoms or signs of arch trouble, 2 had definitely pathologic feet showing symptoms and signs of weakness, and 10 had questionably broken arches. Of these 10, 2 were attempting to enlist and gave no history of foot trouble although their arches yielded markedly under body weight, and the remaining 8 (3 of whom were prisoners) gave confusing histories of indefinite trouble, probably in the hope of avoiding fatigue duty. The third and fourth groups consisted of 20 soldiers who had just marched 1,000 miles with full equipment and in military formation. Ten of these were measured on the first day after entering camp and 10 on the third day. The first 10 (third group) were normal. The second 10 (fourth group) were normal except for one soldier who had moderately pathologic fallen arches which had forced him to ride a part of the distance. The fifth group consisted of 9 hospital cases. Three were normal, 2 were questionably pathologic, and 4 were definitely pathologic. This group included the one female measured, whose arches had broken down during pregnancy, and also one individual with rigid arches who was measured two days after the removal of a plaster cast.

METHODS OF COLLECTING DATA

The various linear and areal determinations were collected in two series; the first was taken directly from the foot, the second was obtained from the footprints. The first series of measurements was taken in the following manner. The weight, age, height of the individual and the history of the previous conditions of his arches were recorded. A brief history was taken in each instance. History of previous illness (especially rheumatic fever), foot injury, arch trouble and pain in feet and legs were noted.[1] The estimation of the arch height by "Heiner's line" was then obtained, but this measurement was discarded in prefer-

[1] Blodgett ('04), in a report on 1,000 cases of broken arches, showed that in 68.1 per cent pain was present only in the feet and that in 25.9 per cent it existed in both the feet and the lower extremities. In 2.2 per cent of his cases, on the other hand, the pain was entirely in the lower extremities above the feet, and in 3.8 per cent there was practically no pain at all. Foot pain, therefore, was regarded to be the most important subjective symptom to be elicited.

ence to the determination of the arch height as the perpendicular distance in centimeters from the tip of the tuberosity of the navicular bone to the floor. Two linear measurements, the medial longitudinal length and the bi-metatarsal width, were obtained by a caliper scaled in millimeters. Since the range of error in measuring with the calipers was about 0.5 of a millimeter no attempt was made to read within the fraction of a millimeter for any linear determinations. The medial longitudinal length and the bi-metatarsal width were obtained with and without the entire body weight upon the arch of one foot.

In order to apply the body weight in a uniform manner, the individual was asked to balance himself on one foot. In this way all of the body weight was directed upon the arch in the line of gravity. The reaction of the arch under body weight, therefore, is a study in statics. In such an investigation the ligaments play the stellar rôle in maintaining the integrity of the arch while the muscles take a minor part.

It is true, to be sure, that the muscles of the foot must be considered to a certain extent even in a study of statics. For instance, in the examination of hypertrophied feet it will be shown later in the paper that hypertrophied muscles are relatively unyielding and tend to support the arch even in a static state. Hubscher ('07) has shown that the supposed general weakness of the supinator muscle groups in cases of flat foot did not exist. He maintained that the flexor hallucis longus was the only supinator clinically insufficient and atrophied in cases of flat foot. Brown ('12) claims that in the static position of the weight-bearing arch the adductor muscles applied their force not at their insertion but at the internal malleolus and the sustentaculum tali, thereby tending to correct pronation. Katzenstein ('14) submits positive proof of the major rôle played by the ligaments in flat foot. He injected ½ to 1 c.c. of weak formaldehyde solution into the plantar ligaments and after holding them in place for three weeks by means of a plaster cast, he found that the relaxed ligaments had been shortened and that the flat foot was functionally normal. Generally speaking the integrity of the ligaments rather than the muscles is being tested when the arches are subjected to static loads.

Footprints were taken for each foot with and without body weight upon the arch. For the footprints, quick-drying, black printer's ink was used. This was spread in a thin film upon the sole of the foot with a rubber roller, and the foot was then placed carefully upon a sheet of smooth finished calendar paper. Impressions were taken with and without the body weight upon the arch. In each case the fixed bony points previously located by ink upon the skin were accurately indicated upon the footprint. In this manner six bony points were projected upon the paper from which measurements could be taken.

The second series of determinations, both linear and areal, was obtained from the footprints themselves.

The linear measurements were made accurately to the nearest millimeter. They were all taken with reference to the fixed bony points which were indicated upon the footprints.

The areal determinations were obtained by means of the planimeter. They are expressed in values of square centimeters and are accurate to 1 square millimeter.

The group of 30 students were studied not only by the addition of body weight upon the arch but also by placing additional loads upon the back. The first weight was 32 pounds, the second 64 pounds. The additional load was obtained by placing on the shoulder a sack containing the respective weights. In all cases footprints and linear measurements were taken as previously described.

The lineal and areal measurements determined were as follows:

(*a*) *Lineal measurements directly on the foot.* (Fig. 1.)

1. H. T.: Heel-toe length; from the most posterior point on the heel to the tip of the great toe.

2. M. L.: Medial longitudinal length; the distance from the lower tubercle of the head of the first metatarsal bone to a point on the perpendicular line on the medial side of the heel which marked the position of the posterior inferior corner of the internal malleolus.

3. B. M.: Bi-metatarsal length; from the lower tubercle on the head of the first metatarsal bone to the head of the fifth metatarsal bone.

(*b*) *Linear measurements taken from the footprints.*

4. A. D.: Anterior diameter; the width of the footprint between the medial and the lateral anterior points. The medial anterior point indicates the location of the lower tubercle of the head of the first metatarsal bone. The lateral anterior point indicates the position of the head of the fifth metatarsal bone.

5. P. D.: Posterior diameter; the width of the footprint between the medial and lateral posterior points. The medial posterior point indicates the position of the posterior inferior corner of the internal malleolus. The lateral posterior point shows the location of the posterior inferior corner of the external malleolus.

6. L. Ax.: Long axis; the length of the footprint between the heel point and the anterior border of the ball of the foot where it meets the great toe. The heel point is the most posterior point of the heel from a line drawn through the two posterior points. These points indicate the position of the inferior posterior corners of the internal and external malleoli.

7. S. Ax.: Short axis; the length of the footprint between the heel point and the anterior border of the ball of the foot where it is closest to the little toe. The heel point is the most posterior point of the heel from a line drawn through the two posterior points.

8. M. A. L.: Medial arch length; the length from the medial anterior point to the medial posterior point. The medial anterior point indicates the location of the lower tubercle of the head of the first metatarsal

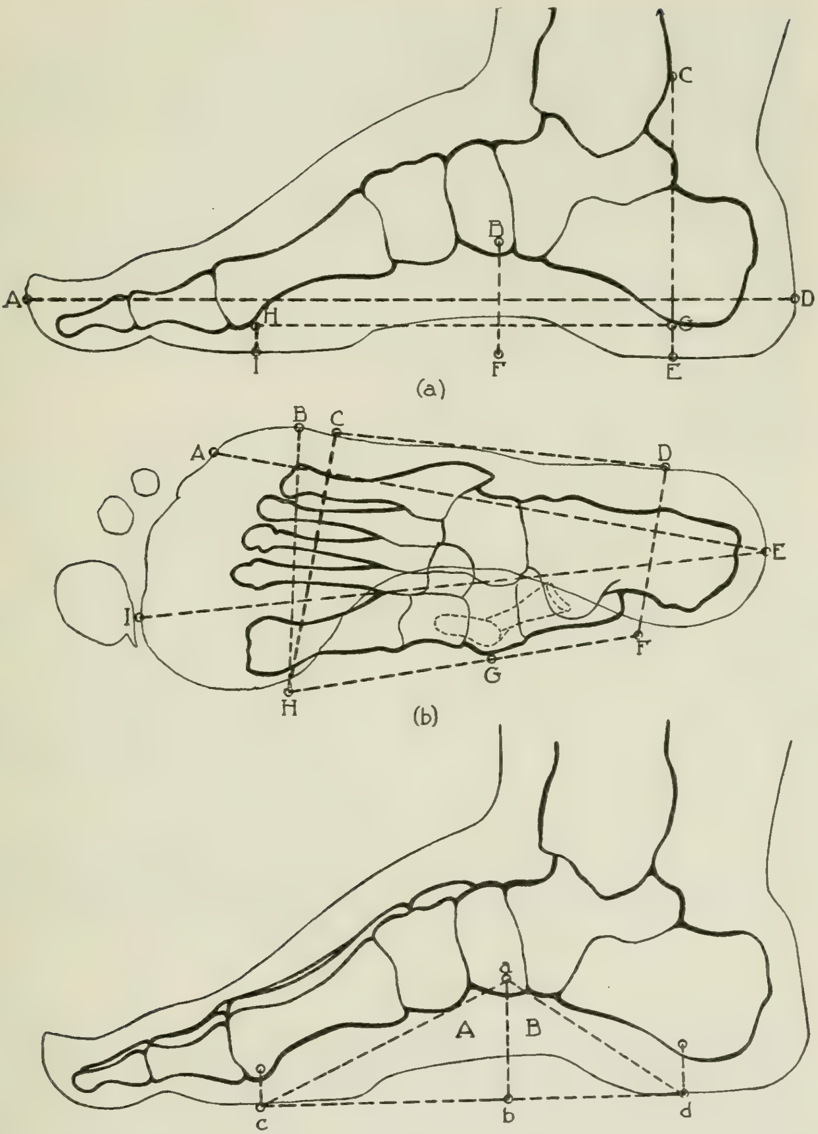

Fig. 1.—Diagram to show the linear and areal determinations which were made.

(a) Medial view; (*AD*) heel toe; (*CE*) the line dropped from the posterior corner of the medial malleolus; (*HG*) medial longitudinal; and (*BF*) arch height.

(b) Inferior view; linear measurements are (*HB*) bimetatarsal; (*HC*) anterior diameter; (*FD*) posterior diameter; (*EI*) long axis; (*EA*) short axis; (*FH*) medial arch; and (*FG*) heel arch length; areal measurements; anterior to line (*CH*), anterior area; posterior to line (*FD*), posterior area; and between lines (*HC*) and (*FD*), middle area.

(c) Medial view; (*A*) anterior triangle; (*B*) posterior triangle; (*db*) heel arch length; (*dc*) medial longitudinal length; and (*ab*) arch height. (Figures modified from Holcomb, '13.)

bone. The medial posterior point shows the position of the posterior inferior corner of the internal malleolus.

9. L. A. L.: Lateral arch length; the length from the lateral anterior point to the lateral posterior point. The lateral anterior point indicates the location of the head of the fifth metatarsal bone, and the lateral posterior point shows the position of the posterior inferior corner of the external malleolus.

10. H. A. L.: Heel arch length; the length from the medial middle point to the medial posterior point. The medial middle point represents the location of the tubercle of the scaphoid (navicular) bone. The medial posterior point indicates the position of the posterior inferior corner of the lateral malleolus.

(*c*) *Areal measurements taken from footprints.*

11. A. B. T.: Area of the big toe.

12. A. S. T.: Area of the second toe.

13. A. T. T.: Area of the third toe.

14. A. Fo. T.: Area of the fourth toe.

15. A. Fi. T.: Area of the fifth toe.

16. A. A. T.: Area of all the toes, viz., the sum of 11, 12, 13, 14, and 15.

17. A. A.: Anterior area; the area of the ball of the foot anterior to a line drawn between the medial and the lateral anterior points. The medial anterior point fixes the location of the lower tubercle of the head of the first metatarsal. The lateral anterior point indicates the location of the head of the fifth metatarsal.

18. M. A.: Middle area; the area of the sole of the foot lying posterior to the boundaries of the anterior area, and anterior to a line drawn between the medial and lateral central points. The medial central point represents the location of the tubercle of the scaphoid (navicular) bone. The lateral central point indicates the position of the tip of the tuberosity of the fifth metatarsal.

19. P. A.: Posterior area; the area of the heel of the foot lying posterior to the line drawn between the medial and lateral central points. The medial central point indicates the scaphoid (navicular) tubercle and the lateral central point locates the tip of the fifth metatarsal.

20. T. A.: Total area; the sum of 16, 17, 18 and 19.

TREATMENT OF DATA

The accuracy of the measurements taken depends upon the nature of the linear and areal determinations and upon the methods employed in taking these measurements. But the significance and the practical value of these data can be ascertained only by the application of statistical and mathematical methods of analysis. The methods used in the study were 8 in number: (1) grouping of all cases in 4 ways—(*a*) by symptoms of weakness, (*b*) by arch height, (*c*) by body weight, and (*d*) by age; (2) calculation of the arithmetic averages of all absolute linear and areal determinations; (3) calculation of the average per cent of change in all linear and areal determinations when the foot is subjected to body weight; (4) calculation, in a group of 60 cases, of the averages of the absolute linear and areal determinations, and of the

per cent of change in these measurements when the foot was subjected to body weight plus the additional loads of 32 and 64 pounds respectively; (5) calculation in the same group of 60 cases of the average absolute increments of areal determinations when the foot was subjected to body weight with the additional loads of 32 and 64 pounds; (6) estimation of the force in pounds, the distribution of force in terms of the per cent of total force and the stress in pounds per square centimeter upon the anterior, middle and posterior parts of the foot when the foot was subjected to weight; (7) computation of the absolute and percentage decrease of the arch height when the arch of the foot was subjected to weight; (8) construction of graphs and figures to illustrate the change in the arch height under load and the distribution of weight placed upon the arch to the various parts of the foot. A more detailed description of the application of these methods is given in the following paragraphs.

1. The 109 individuals were classified in four ways; by symptoms or history of arch weakness, by high or low arch heights, by body weight and by age. The symptomatic arrangement of the 109 cases may be expressed in tabular form and falls into six subdivisions as follows:

Group I. (*a*) Normal feet of college students (29 cases).

Group I. (*b*) Normal feet of soldiers (41 cases).

Group II. Hypertrophied feet of soldiers twelve hours after a 1,000-mile march (10 cases).

Group III. Hypertrophied feet of soldiers seventy-two hours after a 1,000-mile march (9 cases).

Group IV. Questionable pathologic flat feet with symptoms but without obvious physical signs or invalidism (12 cases).

Group V. Moderately pathologic flat feet with symptoms, signs and some degree of invalidism (7 cases).

Group VI. Rigid feet two days after removal of cast (1 case).

Group I, containing 70 normal cases, is rearranged according to the height of the arch. The arch heights, the distance of the tuberosity of the navicular bone from the floor, ranged from 2.8 centimeters to 5.4 centimeters and they were separated into groups, each 4 millimeters in range. Group I was also rearranged according to the age of the soldier, in order to see if any correlation existed between increasing age and linear or areal determinations. Finally, the entire group of cases was reclassified on the basis of body weight. The body weights of the 109 cases ranged from 110 to 198 pounds, and this range was divided into nine intervals of 10 pounds each. In order to appreciate the effect of the various symptomatic groupings upon the body-weight classification, the various groups were incorporated into the classes arranged according to body weight. Five tables were constructed to show the relation between body weight and linear and areal determinations. In each instance the cases were separated, as stated above, into nine groups of 10 pounds range, each within the general range of 110 to 200 pounds. The first table included only the 70 normal cases

of the symptomatic classification (group I); the second, groups II and III, consisted of the 19 cases of hypertrophied feet; the third was based upon groups I, II and III; the fourth on groups IV, V and VI, and the fifth included all groups. For purposes of analysis of the effect of body weight upon the change in linear and areal determinations of the feet, the fifth table, including all normal and abnormal cases, was found to be satisfactory.

2. The arithmetic averages of all absolute linear and areal determinations were calculated. This process needs little explanation since the average is a method ordinarily employed to find the central tendency of data. The absolute averages were obtained for each symptomatic group with and without the body weight upon the foot. They were also secured for the weight and the age classifications, but only when the foot was not subjected to the body weight.

Calculation of the arithmetic averages of all areal determinations was obtained for each of the symptomatic groups as well as for the arch height and the body weight classifications. In each instance the averages were obtained both when the foot was resting and when it was subjected to body weight. However, the arithmetic averages of the areal measurements for the arrangement of the normal cases according to age, were carried out only for determinations made on the resting arch.

3. The average per cent of change was calculated for each linear and areal determination when the foot was subjected to body weight. The per cent of the change in length under a given load was computed in order to secure a common basis for the study of the expansion of the foot in its various dimensions. The increment was first obtained by subtracting the original absolute length or area from the secondary linear or areal determination when the arch height was subjected to the body weight. The percentages that these absolute increments formed of the secondary linear or areal determinations were then averaged. This average served as an index of the reactions of the foot under the body weight. It is necessary at this point to explain the difference between the average of the per cent which has been described above, and the per cent of the average absolute linear measurements, which has an entirely different meaning. A simple example illustrates the difference between them.

	A	*B*	*Per cent* *C*
	3	2	66
	2	3	150
	5	4	80
Average........	3.33	3.00	99

Let column A represent absolute values and column B the increments. The per cents, which the increments form of their absolute values, are indicated in column C. The average is 99 per cent. Since each of the per cents which make up this average represents a real value, the average of the per cent is also a real value. If, on the other hand, one takes the per cent which the average of the increments, column B, forms of the average of the absolute numbers, column A, the answer is 90 per cent. This is a per cent of an average and is an artificial measure. It has no direct relationship with the natural variation of the data itself. Throughout this paper the average of the per cents was always used.

4. The averages of the absolute linear and areal determinations and the averages of the per cents of the increments were calculated in a group of 60 college students, group I (a), when additional loads of 32 and 64 pounds, respectively, were placed upon the foot. The methods were identical with those already described.

5. The average absolute increments caused by the addition of the body weight upon the arch were calculated for all linear and areal determinations and recorded in tabular form. In the case of the 60 college students, the increments of both absolute and areal measurements were obtained, after each additional load was put upon the back, and incorporated in special tables.

6. The force in pounds, the distribution of this force by the arch, and the stress in pounds per square centimeter upon the various parts of the foot were next determined. In each case the force acting upon the foot as a whole was known. Given the body weight, how is it possible to split it up into component parts which go to the anterior, middle and posterior parts of the foot respectively? This cannot be done from the absolute areal determinations because they are not caused by the body weight. The absolute increments of the various areas, however, are due entirely to the force acting upon the arch. Since this is true, it is logical to assume that if the absolute increment of the total area of the foot is caused by the body weight acting upon the arch, the absolute increment of the anterior area of the foot for instance would be caused by that portion of the body weight acting upon the anterior part of the foot. The per cent of the total force to the anterior area of the foot can be expressed by the simple equations:

$$\frac{\text{Increase in total area}}{\text{Total force}} = \frac{\text{Increase in anterior area}}{\text{Force going to the anterior area}}$$

and, solving,

$$\text{Force to the anterior area} = \left[\frac{\text{Increase in anterior area}}{\text{Increase in total area}}\right] \text{Total force}$$

The per cent of the total force going to the toes cannot be calculated by this formula. The increment of the toe area when weight is applied is relatively enormous. The increment in the toe area under increased weights is caused mainly through the action of the muscles of these structures and not by the increased pressure thrown upon them. In all probability only a very small per cent of the total force on the foot is transmitted to the toes. Since the small amount of the total force going to the toes could not be accurately determined, it was omitted in the estimation of the approximate distribution of the force to the anterior, middle and posterior areas of the foot respectively. This distribution was calculated by the formula described above. The increment of the total area caused by body weight acting upon the foot was determined by adding the increments of the anterior, middle and posterior areas.

After the distribution of the force was determined in per cent of the total force for the anterior, middle and posterior areas respectively, the actual force to each respective area could be easily calculated by multiplying the per cent of the total force by the total body weight as explained above in the formula.

The stress, or the weight per unit of area, was calculated by dividing the force acting upon the anterior part of the foot, for example, by the area of this region. The pounds per square centimeter or stress which is obtained in this manner is a true index of the distribution of the body weight upon the various parts of the foot.

The force and stress upon the anterior, middle and posterior areas were calculated for each of the symptomatic groups as well as for the arch height and the weight classification.

7. The absolute and percentage depression of the average arch height was investigated when the foot was subjected to known loads. Actual measurements of the decrease in arch height due to weight is a difficult procedure. The navicular bone does not sink directly under the load but rotates slightly medially and downward. The entire foot can be either pronated slightly or everted in an effort of the individual to balance his weight. This changes the arch height and makes it difficult to measure. The depression can be calculated, however, by a simple theorem of geometry, viz., that the sum of the squares of two sides of a right triangle is equal to the square of the hypotenuse. By a glance at Fig. 1 (*c*), it can be observed readily that the longitudinal arch of the foot is made up of two right triangles *A* and *B*. The line *ab* represents the arch floor height or, in other words, the perpendicular distance from the tubercle of the scaphoid bone to the floor. The line *bd* indicates the heel arch length or the distance from the projected points of

the tubercle of the navicular (scaphoid) and the posterior inferior corner of the internal malleolus. The line *cd* represents the medial arch length or the distance from the inferior corner of the internal malleolus, which was projected upon the footprint to the base of the first metatarsal. It is obvious, therefore, that the heel arch length subtracted from the medial arch length gives a value for the line *cb*. The values of *cb* and *ab* are now known, and the value *ac* or the hypotenuse of the right traingle *A* must be obtained. To do this the theorem of squares was applied.

$$(cb)^2 + (ab)^2 = (ac)^2$$

Solving this equation the value of *ac* is obtained.

$$(ac) = \sqrt[2]{(cb)^2 + (ab)^2}$$

where the values *ac*, *cb* and *ab* represent average measurements upon the normal or abnormal foot not subjected to weight.

When the weight of the body is put upon the arch two changes take place; first, the arch height becomes depressed; and second, the heel-toe length and the medial longitudinal length increase. This is shown by the averages of the two linear measurements with weight upon the arch. The heel arch length and the line *ac* are constant, as will be proven later, and do not change when the body weight is placed upon the arch. This is probably due to the bony supports—the calcaneous and the metatarsals. Since the line *ac* does not change in length, all the increase in the heel toe length must occur in the line *cb*. Likewise the arch height must be lowered as the line *cb* is lengthened. The increase in length of *cb* due to the body weight is determined by actual measurements. The new value of the arch floor height when the arch is subjected to the body weight can then be calculated by the expression:

$$(ab) = \sqrt[2]{(ca)^2 - (cb)^2}$$

in which *ab* is the new arch height, *ca* is the constant distance already determined from the tubercle of the scaphoid to the tubercle of the first metatarsal, and *cb* is the variable distance which has been actually measured from the tubercle of the first metatarsal to a perpendicular line projected downward from the tubercle of the scaphoid.

8. Figures were constructed to illustrate the change in the arch height under loads. Graphs were made likewise to point out the most important stresses upon the anterior, middle and the posterior parts of the foot under various conditions.

DISCUSSION OF RESULTS

The observations and discussion which follow are based upon collected data and upon the tables, graphs and figures which have been calculated and prepared by the methods just described.

Since the discussion covers a number of rather divergent results, it is divided for convenience into fourteen subdivisions as follows: (1) A classification of the etiology of flat foot; (2) the relation of the body weight to average linear and areal measurements and the increments of these absolute determinations, the force, the distribution of the total force and the stress upon the surface of the foot when it is subjected to body weight; (3) the relation of the body weight to the incidence of flat foot; (4) the relation of age to the absolute linear and areal determinations of the normal foot when not subjected to body weight; (5) the relation of age to the incidence of flat foot; (6) the relation of the arch height to the average absolute linear and areal determinations and the increments of these averages, the force, the distribution of the total force, and the stress upon the normal arch when the foot is subjected to the body weight; (7) the comparison of the absolute and per cent decrease in the calculated arch height of the various types of feet, and a comparison of the average absolute and per cent decrease of the normal and the moderately pathologic flat foot under additional loads; (8) a comparison of the average absolute linear and areal determinations and the percentage change of these averages, the absolute increments, the force, the distribution of the force and the stress upon normal and moderately pathologic flat feet when influenced by increasing loads; (9) the comparison of the right and the left foot in absolute and per cent averages, with and without body weight; (10) the comparison of the average absolute linear and areal determinations, of the percentage increase and the absolute increments in these determinations, and of the force, the distribution of the total force and the stress upon normal and abnormal feet when subjected to body weight; (11) the distribution of the force upon the anterior, middle and posterior parts of the foot in terms of per cent of total force; (12) the significance of the stresses upon the various areas of the foot and the rôle played by the bony arch and the tissues in its distribution; (13) the mechanics of the arch of the foot; and (14) the practical significance of the results.

The subdivisions mentioned above will now be considered in greater detail.

1. A classification of the etiology of flat foot necessitates the division of the data into age groups. Below 12 years rickets, fever, and congenital anomalies are the most important factors; above 12 years, fevers, occupational conditions and over weight are largely responsible. Broken arches of children are usually the result of rickets. According to Walsham ('95), rickets caused the broken arches in 96 out of the 103 children whom he examined.

Above 12 years the etiological factors will be considered in approximately the order of their importance.

Trauma and foot strain are proportional to the occupational factors causing them. A twelfth of all the cases of Walsham ('95) and an eighth of all his cases over 24 years of age were caused by sprain. Blodgett ('04), who observed individuals from the laboring class, found trauma to be the cause of flat foot in the majority of his cases. Williams ('09), who examined persons from the middle and upper classes, assigned trauma to fifth place. It is well to remember, however, that trauma as an etiological factor is usually overemphasized by the patient.

Fever and infection should probably be given first place in the incidence of flat foot. Rheumatic fever alone caused one-eleventh of the cases reported by Walsham. Blodgett believed that infection was responsible for one-fifth of the broken arches which he examined.

Wasting illness and debility after long sickness was thought to be an important factor by both Blodgett and Williams.

Weight as a cause will be considered later in the discussion. Tubby, Walsham, and Blodgett emphasized the fact that a sudden increase of weight placed a severe strain upon the ligaments of the foot.

Rickets is of minor importance in the adult.

Time of year is also an etiological factor. The data of both Blodgett and Williams showed that the incidence of flat foot in the spring and summer was at least twice as great as it was in fall and winter.

The significance of sex is disputed and probably depends upon the occupation rather than any anatomical difference between the male and female arch.

2. The growth of the body as indicated by body weight is correlated with the average absolute linear and areal determinations of the foot as well as the absolute increments of these measurements, and it is also related to the force, the distribution of the force in terms of total force, and stress upon the various regions of the foot.

In the body weight classification, as has been described in the preceding pages, the 109 individuals ranging from 110 pounds to 198 pounds were divided into 9 groups of 10 pound intervals. In order to ascertain what effect the various symptomatic groupings (page 19) might have upon the body weight, tables based on the body weight classification were made for different combinations of these groups. Group I, including 70 individuals all having normal feet, is represented in Tables 1 and 2. Table 1 shows the absolute linear and areal measurements when the foot is not subjected to body weight, and table 2 shows the areal determinations when the foot is subjected to body weight. A definite relationship is noticed between the increments in both the linear and the areal measurements and the body weight. The increase is most marked in the longitudinal dimension of the foot, the medial

arch length increasing from 11.3 cm. at a body weight of 110 pounds to 13.8 cm., or about 22 per cent at a body weight of 174 pounds. This extremely large increment is probably caused not only by the growth of the foot in the long axis, but also by the greater stretching of the ligaments under the longitudinal arch when a heavier body weight is placed upon the foot. The absolute increments of the areal determinations before and after the body weight was put upon the foot were noted in each of the various areas measured. They ranged from 15 to 60 per cent. Tables 3 and 4 show the linear and areal measurements on Groups II and III—the 19 individuals with hypertrophied feet. In Tables 5 and 6 the results of Tables 1 and 3 and of Tables 2 and 4 have been united in order to estimate the relation of body weight to all the normal foot measurements. Tables 7 and 8, on the other hand, contain the absolute linear and areal determinations of the questionable pathologic foot, the moderately pathologic flat foot and the two rigid arches. Tables 9 and 10 combine the data of all the groups. The variations of groups II, III, IV, V, and VI from the normal cases in group I are largely due to insufficient data in these groups. A comparison of the various curves of the total area, for example (Fig. 2), shows that the curve representing all groups is almost identical with that based on group I. It was concluded, therefore, that the average absolute linear and areal determinations did not differ essentially in the various types of feet when their relation to body weight was obtained; and that a further analysis of these measurements could be safely carried out upon the combined data of all six groups.

The increments in the absolute areal determinations before and after the foot is subjected to the body weight are shown in Table 11. The absolute increments become larger with the increase of body weight, the anterior area and the area of the toes increasing in the same proportion as the body weight. The posterior and total areas do not increase quite as rapidly in proportion to the increase of body weight while the increments of the middle area become only slightly larger under increasing loads. From these observations it is apparent that the middle area of the foot is almost completely expanded by the weight of a light individual, while, on the other hand, the areas of the toes and the anterior part of the foot almost double their increments when subjected to a heavy body weight.

In Table 12 the force in pounds, distribution of the force in per cent of the total force and the stress in pounds per square centimeter were calculated for the same group of cases from which the absolute increments were obtained. These calculations were carried out by the formula previously described:

$$\text{Force to anterior part of foot} = \frac{\text{anterior area}}{[\text{total calculated area}]} \times \text{total force on the foot}$$

The distribution of the force in per cent of the total force is obviously the per cent which the anterior, middle or posterior area forms of the total area. The force to the anterior area, for example, is found by multiplying the total force by the per cent of the force going to the anterior area. The stress is calculated, in turn, by dividing the total

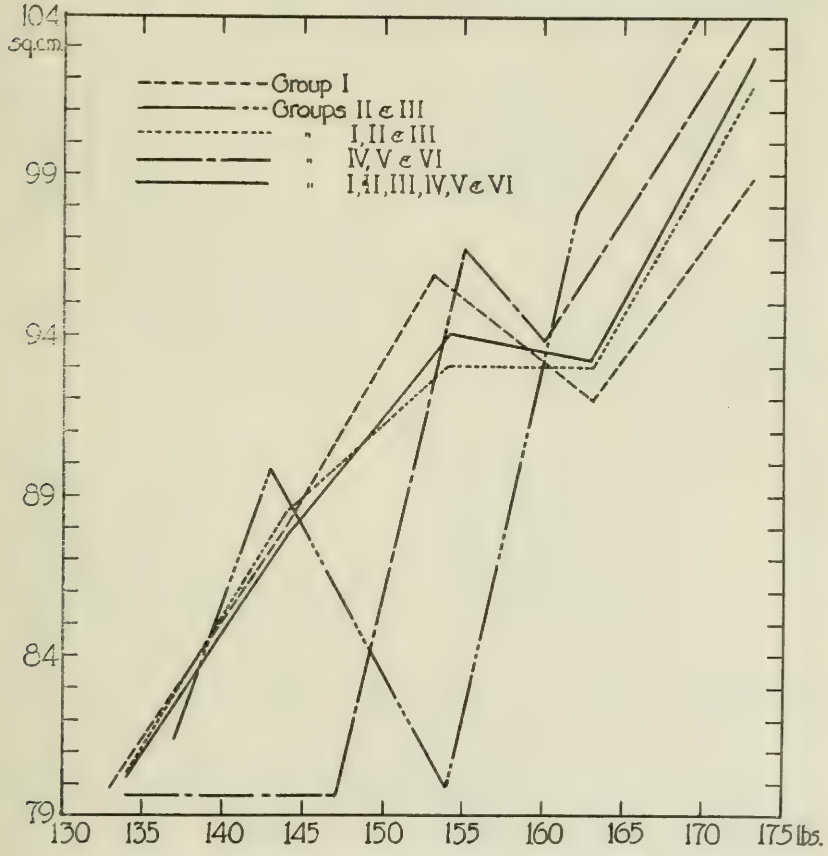

FIG. 2.—Relation of total area (square centimeters) and body weight (pounds).

force into the anterior area. The distribution or the per cent of force going to the anterior area (Table 12) increases from 16.6 per cent at a body weight of 134 pounds to 18.3 per cent at 173 pounds. The per cent of the total force going to the middle area remains practically the same when the body weight increases, while the per cent which goes to the heel decreases slightly. As the body becomes heavier,

therefore, a greater per cent of the weight is shifted upon the ball of the foot, and a correspondingly smaller per cent of the weight falling on the arch remains practically constant. The amount of force in pounds to the anterior, middle and posterior areas becomes greater in all cases as the load is increased. The anterior area receives approximately 18 pounds at a body weight of 114 and about 42 pounds at a body weight of 195, the middle area or arch of the foot sustains the

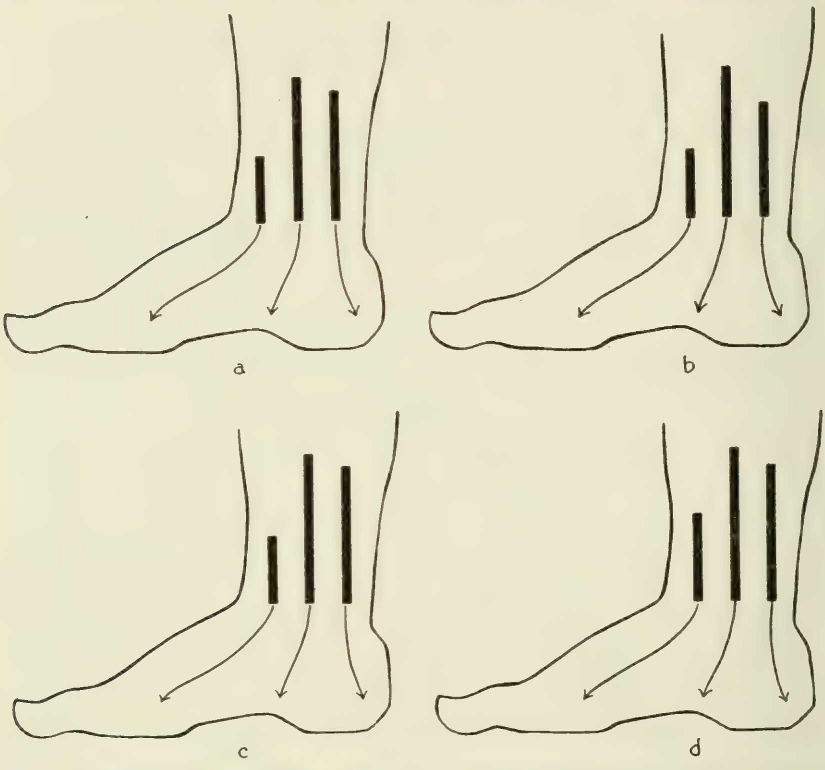

FIG. 3.—Diagrams to show the stress (pounds per square centimeter) acting upon the anterior, middle and posterior areas of the foot; (a) when the foot is subjected to a body weight of 134 pounds, (b) 144 pounds, (c) 154 pounds, and (d) 163 pounds.

greatest bulk in actual weight, ranging from 79 pounds at 114 pounds of body weight to 120 pounds in an individual weighing 195 pounds. The posterior area receives about 17 pounds and 32 pounds at the respective body weights of 114 and 195 pounds. This means that the great bulk of the weight is supported by the middle arch area which also is the largest subdivision of the total area of the foot.

The stresses upon the anterior, middle and posterior areas of the foot were obtained by division of the absolute weight by the area in

square centimeters to which it is distributed. The results are shown in Table 12 and graphs 3 and 4. The stress on the anterior area rises from 0.68 pound per square centimeter in an individual weighing 134 pounds to about 0.86 in one weighing 173 pounds. The stress of the middle area for the same range of body weight increases from 1.53 to 1.64 pounds per square centimeter, and that of the posterior area, from 1.38 to 1.44. In other words, the stress on the anterior area increases almost 2/10 of a pound per square centimeter when the body weight shifts from 134 to 173 pounds, the stress on the middle area increases not

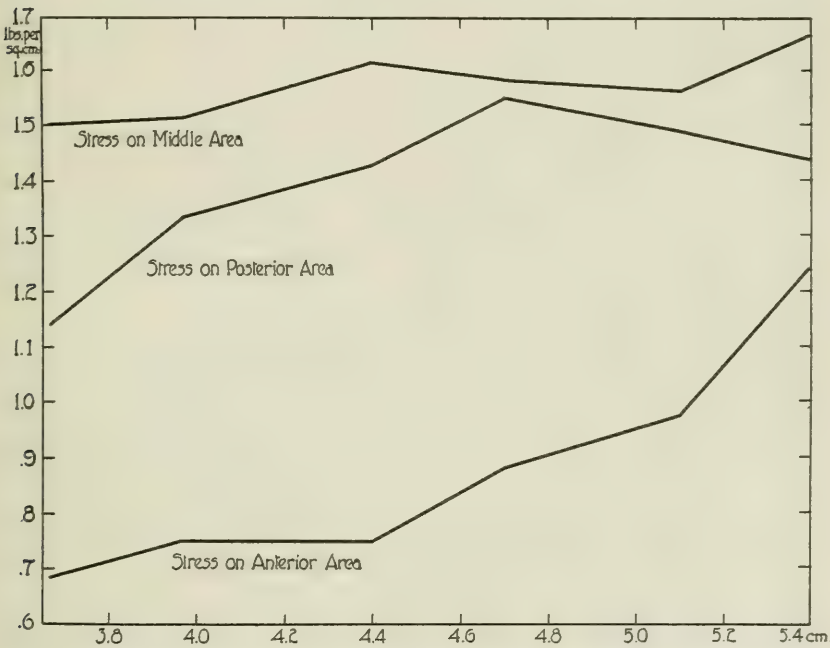

FIG. 4.—The change of stress upon the anterior, middle and posterior areas when the foot is subjected to an increasing body weight.

quite 1/10 of a pound per square centimeter, and that of the posterior area only about 1/16 of a pound per square centimeter. This signifies that in an individual of light weight, the heel is taking practically all the weight that it is possible for it to assume, while the anterior part of the foot, on the contrary, is not used for weight bearing to the same degree that it is in a heavy individual.

3. The relation between flat foot and body weight has been discussed by various investigators. Tubby ('12) and Blodgett ('04) emphasized the fact that overweight or a sudden increment of weight was a prime factor in arch trouble. Williams ('09) agreed with them

but believed that weight in itself was not a matter of great importance. United States Army statistics ('20 and '21) proved that men with flat foot were relatively heavy. The average body weight of 867,757 men accepted in the first million draft recruits was 141.54 pounds. Of this number 175,358 were men with flat feet who had an average body weight of 143.24 pounds—a difference between the averages of 1.7 pounds. The average weight of the 692,399 men with normal feet was calculated and found to be 139.84 pounds. The total difference, therefore, between the average body weight of those men with normal arches and those with broken arches was 3.4 pounds. Examination of

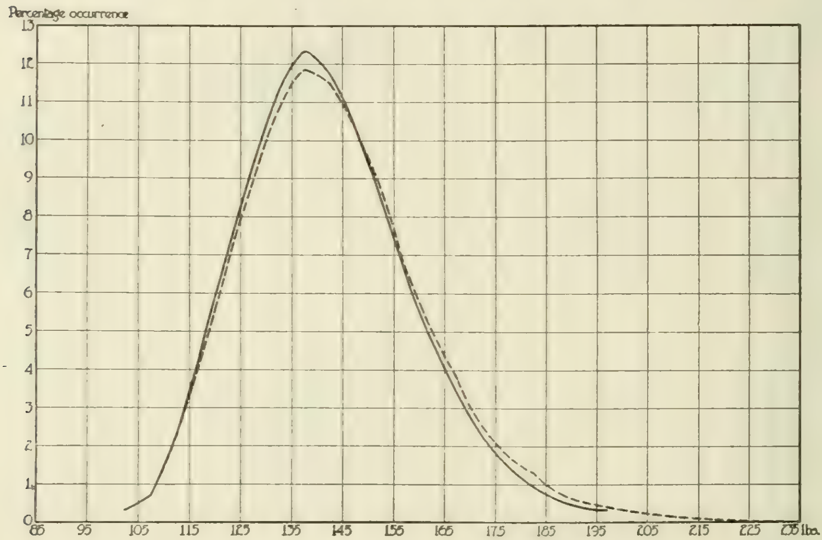

Fig. 5.—Relation of body weight to the incidence of flat foot. Solid line is the percentage distribution curve of normal individuals; broken line, the frequency curve of a group with flat feet.

the data upon the second million draft recruits yielded practically identical averages. The arrangement of the data in the U. S. statistical reports makes it impossible to compare identical distribution of the body weight curves in the two classes of individuals. By shifting to the percentage basis, however, it is possible to demonstrate the difference between the weight distribution of men with normal and abnormal feet. The solid line in Fig. 2 represents the percentage distribution of the body weight of the 867,757 men in the first million draft recruits. The broken line indicates the percentage frequency polygon of the individuals with flat feet. Since the heavy curve includes both normal and abnormal cases the differences shown in the figure are not as striking as they are in reality. The apex of both curves comes at a body weight

of 137.5 pounds. Each frequency polygon is skewed to the left because of the selective elimination of those men who are under weight. Above a body weight of 150 pounds, the percentage incidence of men with flat feet is uniformly larger; below, it is smaller. These data prove, therefore, that a correlation exists between body weights over 150 pounds and flat feet. This correlation is not of great importance and is frequently overlooked in a small number of cases.

4. The normal cases constituting the 70 individuals of group I were reclassified according to age in order to see if any relation existed between age and the absolute linear and areal determinations of the normal foot. The results (Table 13) were practically negative. To be sure, the anterior area of the foot seemed to show a steady increase from 27.4 square centimeters at about the eighteenth year to 30.2 square centimeters at the thirty-third year, but there was also a slight gain in the absolute body weight during this period which could easily account for this increase. It is safe to conclude, therefore, that increasing age in the interval from sixteen to thirty-four years has no significant relationship to the absolute linear and areal measurements upon the foot.

5. There is a correlation between age and the incidence of broken arches. The foot of the infant is normally anatomically flat. Comprehensive studies on this matter by Dane ('98), Selter ('00) and Spitz ('04) have shown in general that the arch of the infant is not flat and that the anatomically flat appearance is due largely to a plantar pad of fat. In the adolescent and adult the incidence of the broken arch varies considerably with the class of people under observation. Four principal sets of data (Table 14) are available for reference: Walsham and Hughes ('95), Whitman ('19), Blodgett ('04) and Williams ('09). All of these investigators except Williams carried on their studies among the laboring class of people. Walsham and Hughes examined the arches of 1,078 individuals; Whitman studied 1,000; Blodgett, 974; and Williams, 300. The bulk of Blodgett's cases were over 30 years of age. His data, therefore, were not analagous to those of Whitman and Walsham. The 300 individuals examined by Williams varied greatly from those of other investigators since they were for the most part women from the middle and upper classes. The extremely high incidence of flat feet between 10 and 20 years indicated by the data of Whitman and Walsham, about 50 per cent of the total, undoubtedly signifies the occurrence of the so-called occupational broken arch. This tends to prove the contention of Tubby ('12) that age, in all probability, is correlated with broken arches only to that degree that it is simultaneously associated with occupational factors.

6. After grouping the data according to age and weight, the normal cases were classified according to the height of the arch. Only the averages of the areal determinations were calculated, but these averages were determined for both the resting foot and the foot subjected to body weight.

The absolute areal measurements, Tables 15 and 16, set forth in parallel columns the absolute areas before and after the body weight was applied to the foot. As the arch height becomes greater when the foot is not subjected to body weight, the area of the anterior, middle and posterior parts of the foot become progressively smaller in size. The average body weight remains practically the same, and consequently cannot be the cause of this condition. When the foot is subjected to the body weight, however, the absolute areal measurements of the anterior part of the foot remain practically the same, while those of the middle and posterior areas decrease slightly. The higher the arch, therefore, the smaller is the absolute area of the foot needed to support the same amount of body weight.

The increments of the absolute areal determinations with and without the body weight upon the arch (Table 17) demonstrate the fact that a high arch height more than doubles the increments of the anterior area while it leaves those of the posterior and middle areas practically the same. This means evidently that a high arch throws more of the body weight upon the anterior part of the foot than it does upon the heel. The percentages which the average increments of the various areal determinations form of the absolute areas when the foot is subjected to the body weight are tabulated in Table 15. During the elevation in arch height from 3.7 to 4.7 cm. the toe area is increased 3 per cent and the anterior and posterior areas about 4 per cent, while the middle area decreases approximately 3 per cent. This apparently indicates that, as the arch height becomes greater, the arch itself becomes relatively more rigid while the anterior and posterior areas become more expansible.

The force, distribution of force, and stress upon the anterior, middle and posterior areas of the foot (Table 18) were next computed as described in the section of the paper on methods.

As the arch height increases one centimeter (from 3.7 to 4.7 cm.) the per cent of the total force upon the anterior area rises from 16.4 to 19.5, and the per cent going to the posterior area increases from 13.2 to 16.2, while the per cent upon the middle area drops from 70.5 to 64.2. This indicates that as the arch becomes higher a greater per cent of the total force is thrown anteriorly upon the ball of the foot and posteriorly upon the heel.

The absolute amount of force in pounds upon the foot increases as the arch height becomes greater. In the anterior area it rises from 22.6 to 29.3 pounds, and in the posterior area from 18.2 to 24.4 pounds as the arch increases one centimeter in height. However, the absolute weight upon the arch of the foot remains about the same. The stress in pounds per square centimeter increases steadily in the anterior part of the foot as the arch height is elevated from 0.69 to 0.88 and from 1.15 to 1.55 in the heel (Fig. 6). The stress in the arch of the foot, however, remains about the same, increasing only from 1.5 to 1.59 pounds per square centimeter.

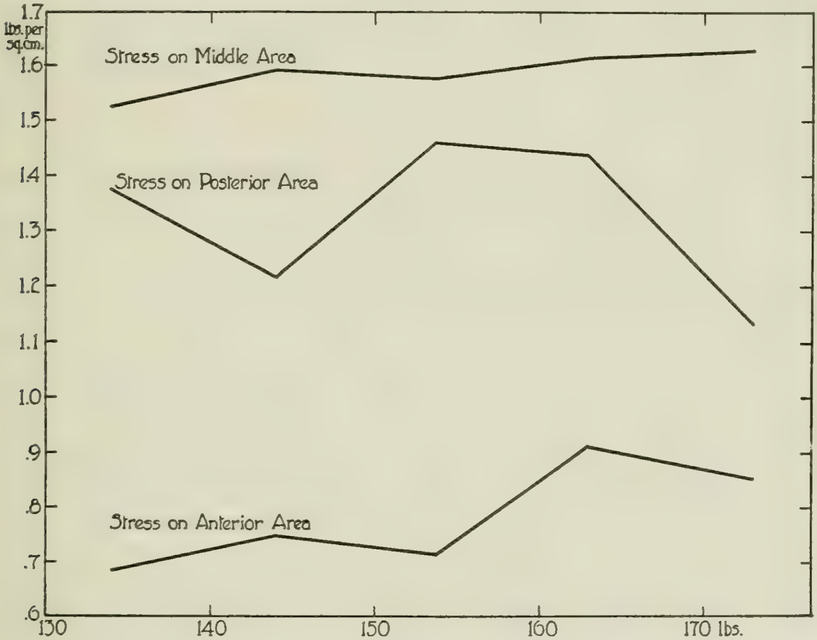

Fig. 6.—The change of stress upon the anterior, middle and posterior areas when the arch height is increasing.

The effect of arch height and the manner in which the low and the high arches distribute force is shown, therefore, by both the per cent of the total force and by the stress upon the middle area of the foot. The force upon the arch area is approximately the same whether the arch be low or high. As the arch becomes higher, however, an increased weight is thrown upon the ball of the foot and the heel, thus keeping the stress upon the arch approximately the same.

7. The effect of arch height was also studied by comparing the absolute and the percentage decrease in the calculated arch height of the various groups of individuals, as well as by comparison of the

average absolute and percentage decrease of the normal and moderately pathologic flat foot subjected to additional loads.

The depression of the arch height in normal and abnormal feet (Table 19) was calculated as described in the section (7) upon methods. In all computations the heel arch length (Fig. 1) was taken as a constant, 4.54 cm. The average absolute observed arch height of all six groups varied less than one-half of a centimeter. The average observed arch height of the normal foot was 4.35 cm. the highest of any group; the rigid arch height was the lowest, 4 cm. The calculated average absolute arch height varied from 3.8 cm. in group II to 0.8 cm. in group V or a range of 3 cm. The range in the calculated arch height of the various groups with the foot subjected to body weight was six times as great, therefore, as the range in the observed arch height in the same groups when the foot was not subjected to the body weight. The absolute depression was obtained for each group of cases by subtracting the calculated arch height from the observed average arch height. The per cent which this absolute depression formed of the original length was also computed. The depression of the normal arch, group I, was 0.62 cm., which amounted to 14 per cent of the original height. The hypertrophied feet of the soldiers, who were measured on the first day after ending a 1,000-mile march, showed an absolute depression of 0.37 cm. and a percentage depression of 8.8. The strong, hypertrophied plantar muscles of these soldiers held their arches practically rigid and unchanged even when the entire body weight was put upon them. The hypertrophied feet of the soldiers, who were measured three days after their 1,000-mile journey, showed a striking change. The absolute depression and the percentage depression of the arch under the body weight were practically identical with those of a normal foot. In three days' time the strong muscles of the foot supporting the arch had changed in their physiological reaction. The size of the muscles under the longitudinal arch still indicated a distinct muscular hypertrophy. Functionally, however, the arch had already reverted to the normal type.

The calculated depression of the arch height in the case of the moderately pathologic flat foot was 3.42 cm. or 80 per cent of its original length. This measurement is by far the most striking difference between the normal and the broken arch. In all cases the moderately pathologic flat foot showed considerable muscle under the longitudinal arch and, therefore, this extreme depression of the arch height when subjected to body weight could not be due to the lack of muscular development. It must be the ligaments, therefore, which limit the descent of the arch in the normal foot. When these ligaments become loosened, attenuated

or broken, the arch gives under the body weight regardless of whether the plantar muscles are weak or strong.

A graphic portrayal of these results (Fig. 7) shows the per cent depression of the hypertrophied, normal and moderately pathologic flat foot. The line *BD* represents an arch height of 100 per cent. The line *AB* is a constant and the medial longitudinal length *AC* is also considered to be 100 per cent of that measurement. The per cent of depression of the normal foot increases the medial longitudinal length by *FA*. The enormous depression of the arch height to *JD* which occurs in the moderately pathologic flat foot only increases the medial longitudinal arch by the per cent *EA*. As will be shown later in the discussion, the depression of the high arch has a much greater relative effect than has an equal depression of a low arch. It is because of

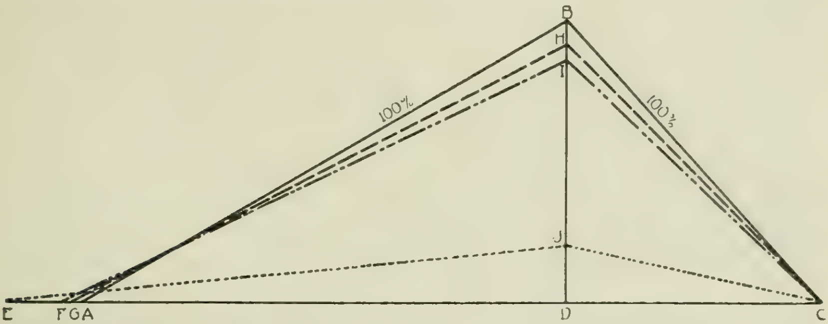

Fig. 7.—Diagram of the depression of arch height in per cent of the original arch height when the foot is subjected to body weight; (*BH*) depression of the arch height of the hypertrophied foot; (*BI*) depression of the arch height of the normal foot; and (*BJ*) depression of the arch height of the moderately pathologic flat foot.

this fact that the differences between the normal and abnormal arch are masked when simple linear measurements of the foot in the long axis are taken.

The depression of the arch height of normal and moderately pathologic flat feet under additional loads (Table 20) was calculated in the same manner as previously described. It was from these data that the heel arch length was determined to be a constant. In securing the data it was extremely difficult to project a perpendicular line from the tuberosity of the navicular bone upon the footprint and, therefore, there was considerable experimental error in the determination of the heel arch length. The average heel arch length was obtained, however, for the resting foot, for the arch subjected to body weight, and for the foot when the individual had an added weight upon his back. The average heel arch length was 4.57 centimeters for the resting arch, 4.52 with the body weight, 4.52 with the body weight plus an additional

32 pounds and 4.55 with the body weight plus an additional 64 pounds. Obviously, it would be quite impossible for the heel arch length to become less with the weight of the body upon the foot than it was in the resting foot. The average of these measurements was 4.54 cm. which was taken, therefore, as an approximate constant and was used in the computation of the arch heights of all the various groups.

In the calculation of the depression of the arch due to the various additional loads placed upon it, the hypotenuse of the right triangle, viz., the line from the tuberosity of the scaphoid to the head of the first metatarsal was considered as a constant since this distance did not change when the arch heights under increasing loads were calculated.

The absolute and the percentage depressions of the normal foot and moderately pathologic flat foot will next be considered. Only one individual of the 30 college students had broken arches. The arches in his case approached more nearly the normal than any other case in the pathologic group, although there had been mild symptoms of arch trouble for nearly a year. The percentage depression of the arch height under the body weight in his case was 15, which approximates the average normal depression, and the per cent of depression of the arch height (Table 20, *b*), caused by the addition of 32 and 64 pounds respectively, is proportionally the same as in the normal foot. The percentage decrease of the broken arch, however, is greater than in the normal arch when increasing loads are placed upon the foot. Under an added load of 32 pounds the broken arch decreased 6.5 per cent of its original height, the normal arch only 4.5 per cent, and under an additional load of 64 pounds the broken arch descended to 13 per cent, while the normal arch fell to about 9 per cent.

The depression of the arch height, therefore, is directly proportional to the load put upon the arch both for the normal and the moderately pathologic flat foot. The absolute and percentage depression of the normal foot is considerably less, however, than that of the moderately flat foot under approximately the same loads.

8. The effect of increasing loads upon the arch height is analogous to other changes in the normal foot when it is subjected to increasing loads. A comparison will be made, therefore, of the average absolute linear and areal determinations and the percentage change of these averages, of the absolute increments, of the force, of the distribution of the force, and of the stress upon the normal and the moderately pathologic flat foot when it is subjected to increasing loads.

The average absolute changes in linear and areal determinations of the normal foot and the moderately flat foot when they are subjected to body weight are given in Tables 21, 22 and Figs. 8 and 9.

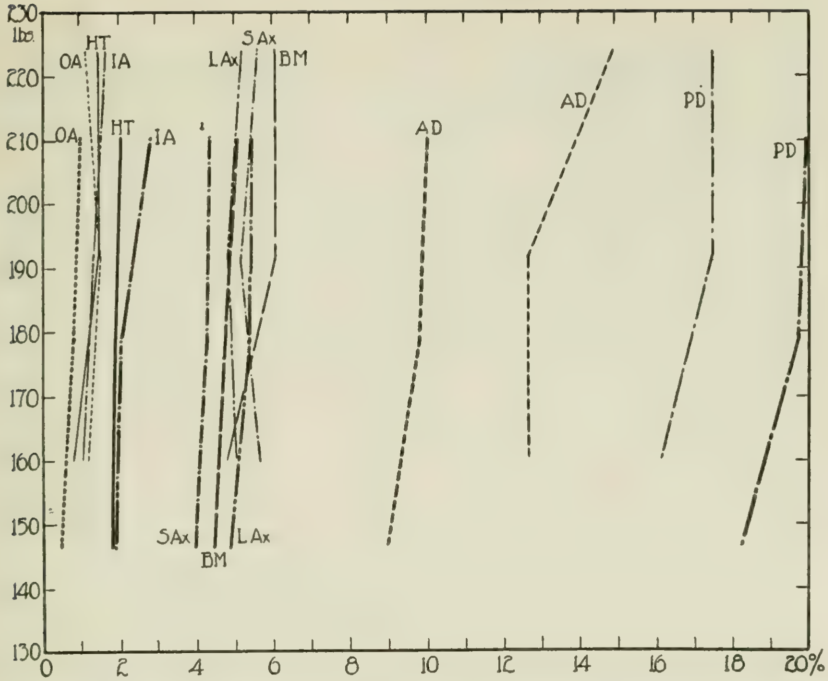

FIG. 8.—The percentage increase in linear determinations of the normal and moderately pathologic flat foot when subjected to increasing loads. The heavy lines represent 58 normal cases; the light, 2 abnormal ones; (*HT*) heel toe; (*OA*) lateral arch; (*IA*) medial arch; (*LAx*) long axis; (*SAx*) short axis; (*BM*) bimetatarsal; (*AD*) anterior diameter; and (*PD*) posterior diameter.

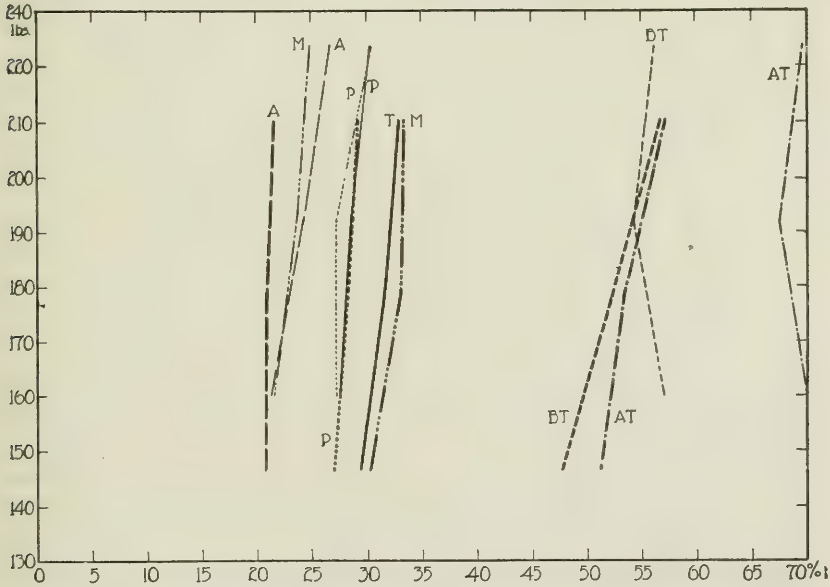

FIG. 9.—The percentage increase in areal determinations of normal and moderately pathologic flat feet when they are subjected to increasing loads. The heavy lines represent 58 normal cases; the light 2 abnormal ones; (*A*) anterior area; (*M*) middle area; (*P*) posterior area; (*BT*) great toe area; and (*AT*) all toes.

The average change in all the linear measurements is quite small and in the more difficult measurements comes within the margin of error. Most of the averages, both linear and areal, show a definite and progressive increase.

The average percentage change of the normal and abnormal foot when subjected to increasing loads, Tables 23 and 24, offer some interesting comparisons. In practically every measurement of the normal foot the per cent increase is in direct proportion to the body weight. The greatest per cent increase in linear measurements for the normal foot is the medial arch length which increases from 1.91 per cent to 2.9 per cent. The outside arch also increases from 0.6 per cent to 1.1 per cent under the influence of the additional load. Whether this increase represents entirely the tissue reaction to the increasing loads or the so-called lateral longitudinal arch has not been determined. The middle area shows the greatest percentage increase (approximately 3.4) when the normal foot is subjected to an additional 64-pound load. The posterior area increases about 2.4 per cent and the anterior area less than 1 per cent. In the moderately pathologic flat foot, also, the increase in the middle area is 3 per cent, but the increase of the posterior area has become 3.4 per cent, and that of the anterior area about 5.5 per cent. This extremely large difference in the percentage of increase in the anterior area of the moderately flat foot as against the anterior area of the normal foot, when the arch is subjected to additional loads, is due to a factor already considered—viz., that increasing weights always raise the stress or the force per square centimeter more markedly in the anterior area than in any other.

The absolute increment in the linear and areal determinations upon the normal foot (Table 25) and upon the moderately flat foot (Table 27) decreases in approximately proportional amounts as additional loads are placed upon the foot.

The force, distribution of force and the stress upon the normal foot and upon the moderately pathologic flat foot are shown in Tables 26 and 28 respectively. The per cent which the force to a given area forms of the total force is approximately the same for the normal and abnormal cases. About 23 per cent of the total force is distributed to the anterior area, and this does not seem to change to any great extent under additional loads. About 60 to 63 per cent of the body weight is distributed to the middle area and about 13 per cent to the posterior area. The actual force in pounds increases rapidly as the additional weights are added. The force on the anterior area, in both the normal and the moderately pathologic flat foot, increases about 12 pounds or one-fifth of the added weight, and on the heel, about 8 pounds or one-seventh of the additional weight.

The stress, or pounds per square centimeter, upon the anterior area, or ball of the foot, is approximately 0.45 in the normal foot as against 0.31 in the abnormal. In the middle and the posterior regions of the foot the stress is considerably greater in the normal than in the abnormal. In the middle area it is about 0.52 in the normal to 0.32 in the pathologic foot, while in the posterior area the difference is 0.43 pound per square centimeter in the normal to 0.36 in the broken arch. These results indicate that loads placed upon the normal arch are distributed, for the greater part, first upon the arch itself, next upon the heel and least upon the ball of the foot, while in the case of the moderately broken arch the greater portion of the additional stress caused by a load upon the back is distributed to the ball of the foot, the heel and the arch obtaining about equal and smaller portions of the added burden.

9. All absolute and percentage averages based upon the data of both the normal and abnormal were first calculated for the right and the left foot separately and then for the two considered together. The average absolute linear and areal determinations of the right and the left foot, both with and without the body weight upon the arch, are indicated in Tables 29, 30, 32 and 33. The percentage change in the linear and areal determinations upon the right and the left foot when the weight of the body was acting upon the arch are shown in Tables 31 and 34. By checking the number of times the right or the left measurements predominated over the other an approximate evaluation of the two sides was obtained. It was found in the consideration of the absolute measurements, with and without the body weight upon the arch, that the left side was greater than the right almost twice as many times. The percentage increases were just reversed, the right being larger in about twice as many cases. The significance of this fact is doubtful. Considerable work has been done in an attempt to establish a predominance of the proportions of one side of the body over the other with practically no success. Hesitation is felt, therefore, in stating that the left foot is larger than the right since the data are too few to be sure upon this point.

10. The differences between the right foot and the left are distinctly minor in character. In each case both the absolute and the per cent determinations on the right and the left foot were averaged together and therefore the number of cases were doubled for each group.

The average absolute linear and areal measurements of the foot for each group are shown in Tables 35 and 36. The absolute determinations of the foot which is not subjected to body weight (Table 35) show that the average age, arch height, body length and body weight

are very nearly uniform for all the groups. Of all the linear measurements, the only group which differs considerably from the normal is group VI, consisting of the two feet with rigid arches. In this group the anterior diameter of the foot is 6.5 cm. and the posterior diameter 3.7, as compared to the normal of 8.2 and 4.4 respectively. The absolute areal determinations of the resting foot also closely approximate the normal except the middle area of group VI. In the rigid foot this area is practically half the size of the corresponding normal one, probably due to the disuse atrophy of the plantar muscles while the foot was in a plaster cast.

All the average absolute linear and areal determinations upon the various groups of feet which are subjected to the body weight agree very closely with the normal measurements with the exception of the middle area of the rigid arch. Although this area has increased more than double its original area without the body weight upon the foot, it is still about 20 square cm. below the area of the normal foot.

The percentage changes in the absolute areal and linear determinations when the foot is subjected to body weight are shown in Table 37. By a comparison of the percentage increase under load of all linear and areal determinations of each group with the percentage increase of the measurements of the normal foot under similar loads, an index may be obtained of the reaction of each group. The hypertrophied feet of the soldiers who were measured 24 hours after the completion of a 1,000-mile hike show a smaller percentage increase in every linear and areal measurement over those of the normal foot, except the anterior diameter, which is slightly greater. The increase of the inside arch length is only about one-half that of the normal foot, indicating that the hypertrophied plantar muscles prevent the bony arch from yielding to the extent of the normal arch. The anterior, middle and posterior area of the foot shows an increase of 2 to 3 per cent less than that of a normal foot under similar loads.

The hypertrophied feet of the soldiers measured 72 hours after completion of the 1,000-mile journey show a decided change. Every linear measurement of the foot increased to a greater extent under the body weight than do those of the normal foot. The change in the bi-metatarsal length, for instance, is one-half of one per cent greater in the hypertrophied feet than in the normal; in the anterior diameter, it is practically 4 per cent larger, in the posterior diameter 2 per cent, and in the long axis, about one-half of one per cent. In the areal determinations, likewise, there is a greater per cent of yielding than in the normal foot. The middle area of the hypertrophied foot after a three-day rest yields 9 per cent more than it does in the normal foot. The anterior

area is about the same as in the normal. The heel area, however, increases 2 per cent more in the normal foot than it does in the hypertrophied foot after a three-day rest.

These results signify that: First, a hypertrophied foot becomes uniformly more unyielding when it is subjected to a load; second, this resistance of the foot against change is due in a large degree to muscular hypertrophy which keeps both the transverse and the longitudinal arch from yielding; third, that the firmness of these hypertrophied muscles disappears very quickly when they are allowed to rest; and, finally, that the connective tissues of the foot are toughened by long marches, since these tissues obviously do not become softened after two or three days of rest. Muscular hypertrophy, therefore, is followed by a period of extreme laxness of the muscles when the cause of the hypertrophy is removed.

The per cent which the moderately pathologic flat foot increases in its linear and areal determinations when it is subjected to body weight is greater in all instances than in the normal foot. The differences between the pathologic and the normal foot in the decrease of the anterior diameter is especially marked, being 13.6 per cent in the abnormal and 9 per cent in the normal. This is due probably to the fact that the transverse arch is much more weakened in the broken arch than in the normal. The increase of inside arch length is especially marked, being about 2 per cent more in the case of the pathologic flat foot than in the normal. This change, however, is relatively small and could easily be overlooked if it were not magnified by the calculated arch height previously described.

The per cent which the rigid arches increase in the areal and linear determinations when they are subjected to body weight is evidently a complex resulting from long disuse of the muscles and more or less ankylosis due to the six weeks' confinement of the foot in the cast. Obviously the increments in the anterior-posterior lengths are somewhat fixed by the partial ankylosis of the bones of the longitudinal arch. The transverse arch, however, yields even more than in the case of the flat foot. The anterior and middle areas of the foot both increase practically the same as in the normal, while the middle area shows a far higher rate of increase than does the normal or even the pathologic flat foot. But while the increase in the middle area in the moderately pathologic flat foot is due to the weakness of the ligaments under the longitudinal arch and a tremendous percentage depression in the arch height, the calculated arch height of the rigid foot has been shown to be normal. The increase of the middle area in the rigid arch, therefore, is due to the disuse atrophy of the plantar muscles and the conse-

quent extremely small absolute area in the medial part of the foot when it is not subjected to the body weight.

The absolute increments in the linear and areal determinations of the various groups (Table 38) were next calculated. The increase in toe, anterior and posterior area of all the groups is similar to the normal. All the groups except the hypertrophied feet which were measured on the first day show an increase of the middle area slightly greater than the normal.

Calculation of the force, the per cent of the total force and the stress on the anterior, middle and posterior areas of the foot (Table 39) brings out the unsuspected fact that in all groups of cases, the forces upon the arches are distributed in about the same manner regardless of the condition of the arch. The per cent of the total force and the

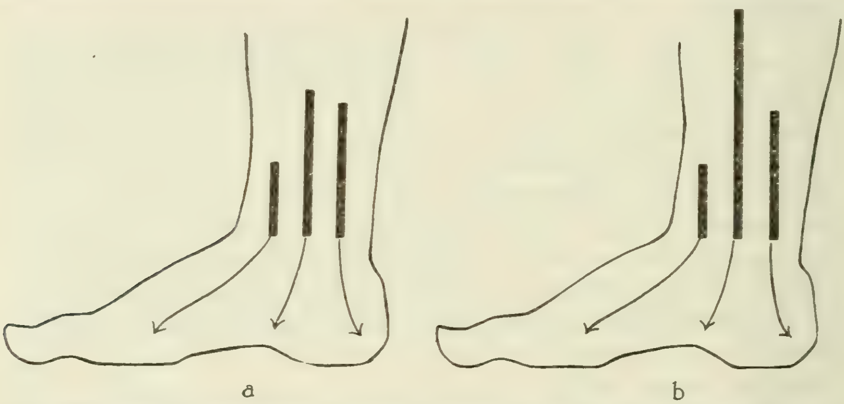

FIG. 10.—Diagrams to show the stress acting upon the anterior, middle and posterior areas of the foot when it is subjected to body weight; (a) foot with normal arch, (b) foot with rigid arch.

stress in pounds per square centimeter which go to the anterior, middle or posterior areas are practically uniform for the greatly hypertrophied feet, for the weak, yielding arch and for the normal arch. In other words, the condition of the arch does not modify the distribution of the force or the stress upon it. These factors depend only upon the height of the arch and upon the amount of the weight to which the foot is subjected. Only one exception to this rule must be made, viz., that the stress in pounds per square centimeter of the middle area of the rigid arch is greatly increased (Fig. 10). This is due to the fact that, while approximately the same per cent of force goes to the arch of the rigid foot, the plantar muscles have become so atrophied from disuse that they offer a relatively small absolute area upon which the force must be applied.

11. The distribution of the total body weight to the anterior, middle

and posterior areas of the foot varies with the weight upon the arch and the height of the arch. If the anterior area is studied (Tables 12, 18, 26, 28, and 39), it is obvious that the total force going to this area increases about 5 per cent as the body weight varies from 110 to 160 pounds, or about 1 per cent for every 10 pounds. There is also an increase of approximately 5 per cent in the force which goes to the anterior area as the arch height is increased from 3.7 to 5.1 cm. This indicates that a heavy individual with a high arch sustains a greater per cent of his total body weight upon the anterior part of the foot than would a person of equal weight with a low arch.

A consideration of the forces acting upon the heel indicates that an increase of body weight makes practically no difference upon the distribution of the weight to the posterior area. An increase of the arch height, however, does throw a proportionally greater amount of the body weight upon the heel. Heavier body weights, likewise, make no difference in the weight distribution upon the anterior area although the height of the arch causes a very decided change in the distribution of forces upon this region. The higher the arch the more efficient it becomes mechanically and the more weight it transmits upon the ball and the heel of the foot, sparing the arch from carrying an added burden of the strain. The per cent of the distribution of the force can be summarized briefly by the following table:

	Per cent of force upon ball of the foot	*Per cent of force upon the arch*	*Per cent of force upon the heel*
High arch	Greater	Less	Greater
Heavy body weight	Greater	About the same	About the same

12. The significance of the stresses on the various parts of the foot is somewhat similar to that of the percentage distribution of the body weight upon the arch.

The stress is given in pounds per square centimeter, and represents a true index of the weight distribution for any given area. A summary of the increase of the stresses can be tabulated as follows:

	Ball of the foot	*Arch*	*Heel*
High Arch	4/10 pound / sq. cm.	No increase	3/10 pounds / sq. cm.
Heavy body weight	5/10 pound / sq. cm.	1/10 pound per sq. cm.	1/8 pound / sq. cm

It is interesting to note that, although the high arch throws a smaller per cent of the total force upon the middle area of the foot, it is still subjected to the same amount of stress in pounds per square centimeter. An increase in body weight raises the stresses to a slight degree in both the middle and anterior areas, while the per cents of the forces upon

these areas do not change to any extent. From a consideration of these data it is apparent that at least two causative factors must be considered responsible for directing the force of the body weight upon various parts of the foot. The first, and by far the most important one, is the mechanical structure of the arch itself. The higher the arch becomes the more efficiently is it able to transmit the force which it supports. The second and less important factor is the various types of tissue in the foot. The heel reaches its absolute limit of reaction against the weight placed upon it when the foot is subjected to a body weight of about 110 pounds. This must be due to the heavy pad of dense tissue upon the base of the calcaneum which can expand only to a definite limit. The combined rôle which the transverse arch and the tissues of which it is composed play in the reactions of the anterior part of the foot cannot be separated from each other, although in all probability the transverse arch is responsible for the bulk of the reaction against the body weight.

13. Since the longitudinal arch of the foot is largely responsible for distributing the weight of the body to the various parts of the foot, the mechanics of the arch, as indicated by the available data, will be briefly considered.

The longitudinal arch may be considered for explanatory purposes as a simple arch with the astragalus as the keystone, and the calcaneum and the metatarsals as the posterior and the anterior pillars respectively. Instead of the pillars resting against solid bulwarks, as do those of a bridge, for example, they are held in position by ligaments and muscles upon their concave surfaces like a bow held taunt by the bow string. In the resting arch these ligaments and muscles are lax, but when the arch is subjected to the weight of the body they become tense as the ends of the pillars try to separate under the downward force. It is obvious that, as the arch becomes higher, it takes a proportionally smaller force to hold the pillars of the arch together since the mechanical advantage is much greater. Less intrinsic power in the ligaments and the muscles is required, therefore, to sustain a high arch than a low one. Let us assume, for the sake of simplicity, that the ligaments stretch directly between the calcaneum and the head of the first metatarsal bone, as is shown diagramatically in Fig. 11 by the line *AC*. How are the ligaments affected when the arch is subjected to the body weight? Fig. 11 shows a high, low and normal arch drawn to a scale of two. If the high arch *DB* is depressed one centimeter under the body weight, the ligaments are stretched an additional distance of *EA*. If the lowest arch *DI* is depressed the same distance of one centimeter, it would only stretch the ligaments of the foot *GA* or about one-third as

much as did the similar decrease of the high arch. It seems clear, therefore, that a depression of a high arch height would strain its supporting ligaments much more than a similar depression of a low one.

On the other hand, as already pointed out, a high arch can be held together by a fraction of the force which is necessary to maintain a low arch. In order to visualize the effects of the various types of arches several sample footprints are included. Fig. 12 (*a*) shows the prints of a normal foot before and after the application of the body weight to the arch. Figs. 12 (*b*), 13 (*a* and *b*) and 14 (*a* and *b*) show examples of prints of moderately pathologic broken arches. The prints of Fig. 13 (*a* and *b*) do not appear flat, although these were both cases showing very marked symptoms. The two cases in Fig. 16 are both normal individuals. The feet represented by Fig. 16 (*b*) were those

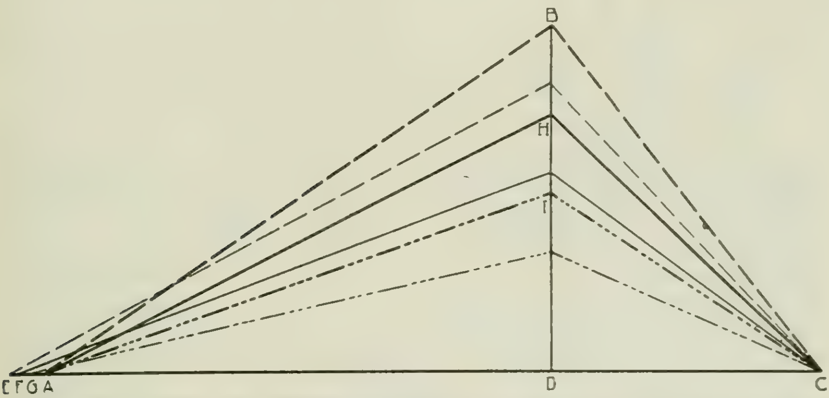

Fig. 11.—Diagram of the effect which the same depression of a high and low arch have upon the medial longitudinal length of the foot.

of a boy about 19 years of age who had never had the slightest symptoms of arch trouble. His weight was 190 pounds and the height of his arch 4.9 cm. In order to support such a heavy body weight upon a relatively short foot, the plantar muscles were greatly hypertrophied. Fig. 16 also represents a foot which is normal in all its reactions to body weight. This individual was a soldier of group II who had marched 1,000 miles without the slightest arch symptoms. Throughout his entire life he had been told that his feet were flat, although they had never given him any trouble. His arch height was extremely low, only 3.5 cm., and yet all the reactions of his foot were perfectly normal. The tuberosity of the navicular bone (shown in the X-ray Fig. 16 (*c*)) does not descend visibly when subjected to body weight. A competent roentgenologist was asked to pass his opinion of these plates, being told that in one case the foot was subjected to body weight and in the

other it was not. His statement was that "both plates show a second degree flat foot, although the bony deformity does not seem to be changed by weight." The arches appear flat in the X-ray, but they are normal according to functional, symptomatic and physiologic tests.

Other investigators have observed that the low arch is not necessarily a broken arch. Hoffman ('07) stated that impressions are of no value to the diagnosis of arch weakness, and Weed ('12) believed that visual examination would not reveal the potentiality of a given foot. The term of *broken arch* should be used entirely in place of the term *flat foot;* or the use of the expression, *flat foot*, should be reserved for only those cases showing definite symptomatic and physiologic weaknesses of the arch.

Extremely high arches, as illustrated by Fig. 17, give an identically opposite picture. This man was also a soldier who had marched 1,000 miles. He had never had any signs of arch trouble and endured the march without difficulty. The left arch height was 4.5 and the right 5.6. The muscular hypertrophy on the left foot was quite marked, while there was only a thin band of muscle under the right arch. There is no doubt that either the muscle would have hypertrophied if it were necessary in order to sustain the arch, or the arch itself would have broken down under the strain of continued marching. The arch, however, was neither broken nor were the muscles hypertrophied. The height of the arch gave the plantar ligaments a great mechanical advantage, and, consequently, they did not require hypertrophy of the plantar muscles to perform the work required of them.

The mechanism of the arch is undoubtedly more complex than is indicated in this description. Certain facts, however, are outstanding: (1) that a high arch is mechanically more efficient than a low one, (2) that the depression of a high arch causes a much greater relative and absolute increase in the ligaments which support it than does a similar depression in a low arch, and (3) that normally low arches are frequently mistaken for flat feet because of the great amount of muscular development with which they are usually associated.

14. The mechanics of the arch of the foot, as well as the distribution of the force upon the various parts of the foot, has a practical significance in clinical medicine.

The proper appreciation of the high arch is most important from a viewpoint of prevention of a broken arch. The physician often thinks of arch pains as inconsequential if the arch is high and apparently normal. As a matter of fact the high arch breaks down more easily, when the ligaments once start to stretch, than does a low one. Although the high arch offers the greatest mechanical advantage, it also probably

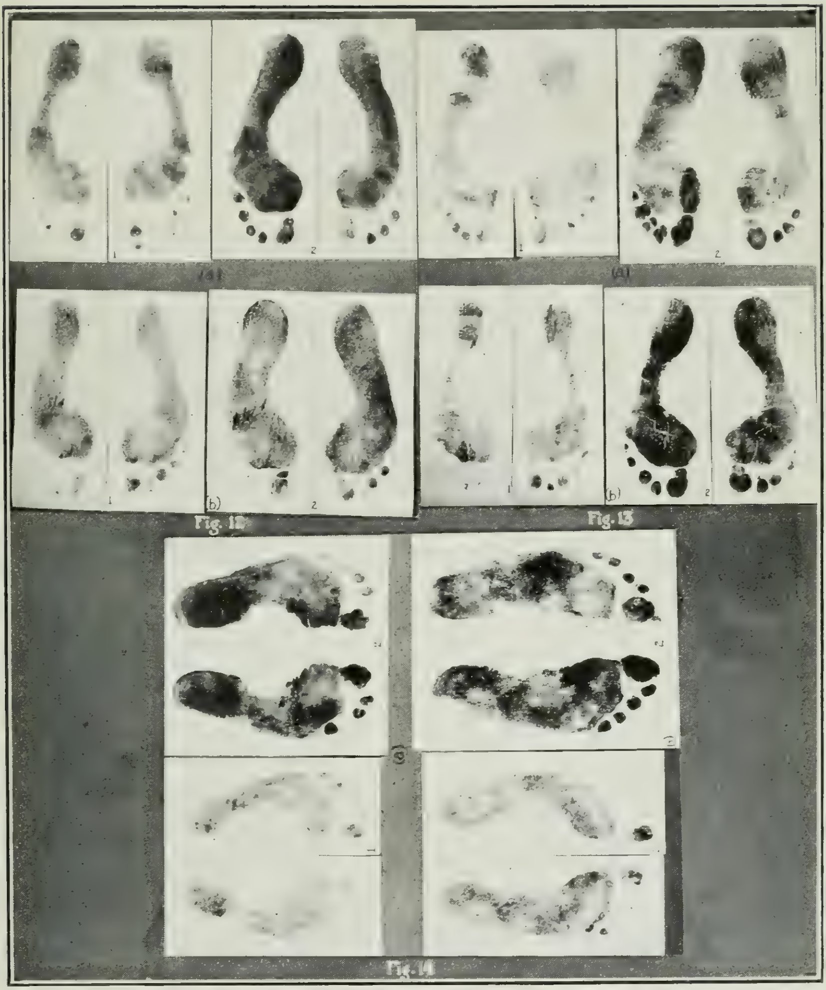

FIG. 12.—(a) Footprints of normal feet: (1) without body weight: (2) with body weight. (b) Footprints of moderately pathologic flat feet; (1) without body weight, (2) with body weight.

FIG. 13.—(a and b) Footprints of flat feet; (1) without body weight, and (2) with body weight.

FIG. 14.—(a and b) Footprints of flat feet; (1) without body weight, and (2) with body weight.

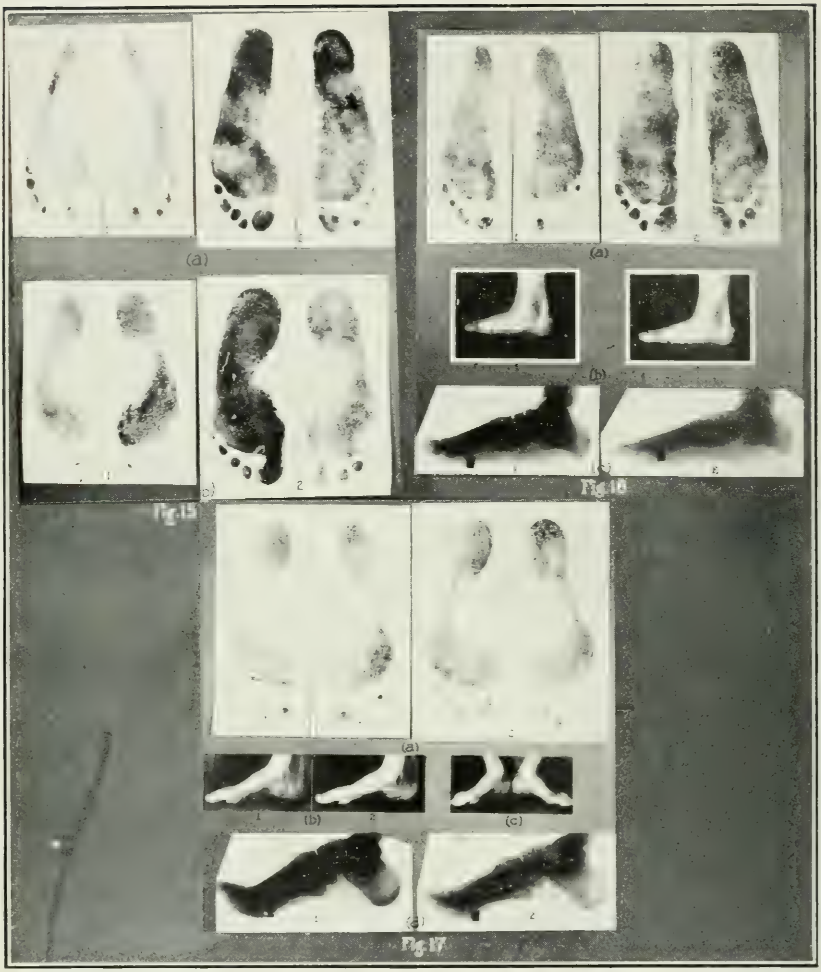

FIG. 15.—(a and b) Footprints of normal feet with low arches; (1) without body weight, and (2) with body weight.

FIG. 16.—(a) Footprints of normal feet with low arch height; (1) without body weight and (2) with body weight.

(b) Pictures of medial view of foot with low arch height; (1) without the body weight and (2) with the body weight.

(c) X-rays of the medial view of normal foot; (1) without the body weight upon the foot, and (2) with the body weight.

FIG. 17.—(a) Footprints of normal feet with extremely high arches, (1) without the body weight, and (2) with the body weight.

(b) Pictures of the right foot with a high arch, (1) without the body weight, and (2) with the body weight.

(c) Pictures of the right and the left foot with and without the body weight upon the arch.

(d) X-rays of the medial view of the right normal foot with a high arch, (1) without the body weight and (2) with the body weight.

has quantitatively less muscle and ligament to support it. Consequently, if the ligaments become weakened from an infection or trauma, there is no reserve muscular power to support the arch. Moreover, a depression of a high arch causes a relatively greater stretching of the ligaments and consequently a greater tension upon them for any given amount of depression. Often the very acute arches are either high or moderately high, since great pain may result from the sudden stretching of the ligaments under the arch. In this case the arch should be tested to see if the ligaments have already been increased in length. If they have not, complete rest should be sufficient in order to restore the foot. If they have already become attenuated, the development of the plantar muscles by exercise should be attempted.

The effect of an additional load upon a moderately flat foot should be remembered, since the increase in the dimensions of the foot are directly proportional to the added weights, and the muscles, therefore, must be accustomed to these additional loads gradually in order to give them time in which to hypertrophy.

The early cases of broken arches can be separated by functional tests from those individuals having acute symptoms but whose plantar ligaments have not yet given under the strain. The greater relative per cent of the medial longitudinal length would suffice to differentiate these in a marked case, but the calculation of the percentage depression of the arch height would be a safer test if the case was a doubtful one. A depression of over 20 per cent should be considered definitely pathological.

The judgment of flat or broken arches by the visual examination by footprints alone, or even by the X-ray, is not sufficient. A functional test under added known weights should be carried out in order to verify the diagnosis.

SUMMARY

1. The relation of the absolute linear and areal determinations to an increase in body weight is not affected by the normality of the arch.

2. The force in pounds upon the anterior, middle or posterior regions of the foot can be calculated by the formula:

$$\text{Unknown force (pounds)} = \left\{\frac{\text{Area of the anterior, middle and posterior part of the foot}}{\text{Total calculated area of the foot}}\right\} \times \left\{\text{Total force on the foot}\right\}$$

3. In an individual of light weight the heel is supporting as large a per cent of the body weight as it does in a heavier person.

4. The greater bulk of the additional weight of a heavy individual is thrown upon the anterior part of the foot.

5. No relation was observed between the age in the interval of 16 to 34 years and the absolute linear and areal determinations.

6. The higher the arch, the smaller is the absolute area of the foot needed to support the same amount of the body weight.

7. A high arch throws a greater per cent of the body weight upon the ball and heel of the foot than does a low one.

8. A high arch decreases the per cent of the total force going to the arch crest or apex and thus maintains approximately the same stress upon the middle area of the foot.

9. The range of the calculated arch height in the various groups of cases when the foot is subjected to the body weight is six times as great as the range of the observed resting arch height in the same groups.

10. The arches of the soldiers, who were measured on the first day after ending a 1,000-mile march, were practically unchanged when they were subjected to body weight.

11. The arches of the soldiers, who were measured three days after their 1,000-mile journey, showed as much depression in the arch height as did the normals when subjected to body weight.

12. The broken arch was depressed 80 per cent of its original height when body weight was placed upon it.

13. The ligaments beneath the longitudinal, bony arch not only support it but also limit the amount of depression when the foot is subjected to body weight.

14. Weakened ligaments of the moderately pathologic flat foot permit the arch height to be depressed more than it is in the normal foot.

15. The heel arch length is a constant when the foot is subjected to body weight.

16. The line from the tuberosity of the scaphoid to the head of the first metatarsal is a constant when the foot is subjected to body weight.

17. The depression of the arch height is directly proportional to the load put upon the arch.

18. The absolute measurements upon the left foot seem to be slightly larger in a majority of cases than they are upon the right. No significance is attached to the fact, however, since the variations are small.

19. The average absolute linear measurements of all the various groups agree very closely with the normal determinations.

20. The hypertrophied feet of the soldiers, who were measured the first day after the completion of the 1,000-mile march, show a smaller percentage increase in every linear and areal measurement than do normal feet.

21. The hypertrophied feet of the soldiers, measured 72 hours after their 1,000-mile journey, show that both linear and areal determinations increase to a greater extent than they do in the normal feet.

22. The hypertrophied feet of the soldiers, measured 72 hours after their 1,000-mile journey, become uniformly more yielding when they are subjected to loads.

23. The firmness of the hypertrophied muscles disappears very quickly when the feet are allowed to rest.

24. The subcutaneous tissues of the foot, especially those of the heel, are toughened by long marches and do not become softened by a few days of rest as do the hypertrophied muscles.

25. The per cent of increase of the linear and areal determinations of the pathologic flat foot are uniformly greater than those of the normal foot.

26. The increase in the middle area of the moderately pathologic flat foot is due to the weakness of the ligaments under the longitudinal arch.

27. The large percentage increase in the middle area of the rigid arch is due to the disuse atrophy of the plantar muscles.

28. The percentage distribution of the force and the stress upon the various areas of the foot does not vary to any extent in the different symptomatic groups.

29. The stress on the middle area of the rigid arch is extremely great when the foot is subjected to body weight.

30. The per cent of the distribution of the force in a high arch is greater upon the heel and the ball of the foot and less upon the arch.

31. The per cent of the distribution of the force, when the foot is subjected to a heavy body weight, is greater upon the ball of the foot and about the same on the arch and the heel.

32. The increase of the stress in pounds per square centimeter in a high arch is greater in the heel and the ball of the foot while there is no increase in the middle area.

33. As the body weight becomes heavier, the increase of the stress in pounds per square centimeter is greater on the ball of the foot and less upon the heel and the arch of the foot.

34. Two causal factors are responsible for directing the distribution of the body weight upon the various areas of the foot: (*a*) the mechanical structure of the arch, and (*b*) the types of tissue in the foot.

35. A comparatively small force is necessary to maintain a high arch when it is subjected to the body weight, and thus the mechanical advantage of the high arch is greater than that of the low.

36. Arches frequently appear to be flat and yet may be absolutely normal according to functional and symptomatic tests.

37. A high arch is mechanically more efficient than a low one.

38. The same amount of depression of a high arch causes a much greater absolute and relative increase in the ligaments which support it than does a similar depression of a low arch.

39. Normal low arches are frequently mistaken for flat feet because of the great amount of muscular development with which they are usually associated.

40. A high arch breaks down, when the ligaments are weakened by infection or trauma, more easily than does a low one.

41. The weakened arch can be best differentiated from the normal by determining whether the percentage depression of the original arch height is greater than 20 per cent.

42. A functional test must be applied to flat or broken arches in order to verify the diagnosis.

CONCLUSIONS

Hypertrophied muscles of the foot are relatively unyielding when subjected to body weight.

Hypertrophied muscles of the foot after a few days of rest become weaker functionally than the muscles of a normal foot.

The medial longitudinal arch of the human foot acts mechanically like a true arch in the distribution of additional loads to which it is subjected.

Both the high and the low arch can be functionally normal.

The reaction of an arch to static forces depends almost entirely upon the integrity of the ligaments by which it is supported.

The best criteria of normal and abnormal arches are functional tests.

BIBLIOGRAPHY

(1) Anderson, W. L.: "New methods used in the study of flat foot at Yale." Med. Times, N. Y., vol. 44, May, 1916, 144.

(2) Baisch, B.: "The structure and mechanism of the normal foot and the flat foot." Ztschr. f. orthop. Chir., Bd. xxxi, 1913. Abstract: Am. Jour. Orthop. Surg., vol. 11, 1913, 183.

(3) Belvoe, B.: "Measurement of bones of foot as aid to better diagnosis and more rational treatment." Jour. Missouri State Med. Assn., vol. 14, 1917, 13.

(4) Blodgett, W. E.: "Analysis of one thousand cases of static foot trouble." Am. Jour. Orthop. Surg., vol. 2, 1904, 146.

(5) Bossi, Pietro: "Flat-foot." Monograph. Abstract: Am. Jour. Orthop. Surg., vol. 6, 1908–9, 558. Abstract: Arch. f. orthop. Mech. u. Unfallchir., Bd. 7, 1908, 82.

(6) Bradford and Lovett: "Orthopedic Surgery" (second edition).

(7) Brown, L. T.: "A consideration of the action of the extrinsic and intrinsic muscles of the foot from an anatomical and mechanical standpoint." Am. Journ. Orthop. Surg., vol. 10, 1912, 18.

(8) Codman, C. A. E.: "Diagnosis and treatment of relaxed and weak foot." Pennsylvania Med. Jour., Athens, April, 1911.

(9) Cramer, F.: "Contribution to the subject of flat-foot." Arch. f. orthop. Mech. u. Unfallchir., Bd. 12, 1913, H 12. Abstract: Am. Jour. Orthop. Surg., vol. 11, 1913, 360.

(10) Dane, J.: "Report of some studies upon the arch of the foot in infancy." Jour. Boston Soc. Med. Sc., vol. 3, Feb., 1898, 209.

(11) Elmore, B.: "Report on the flat foot." U. S. Nav. Med. Bull., vol. 7, 1913, 102.

(12) Feiss, H. O.: "A simple method of estimating the common variations and deformities of the foot." Am. Jour. Med. Sc., vol. 139, 1909, 213.

————: "The use of the term 'flat-foot,' with a note on the diagnostic classification of the ordinary disabilities of the adult foot." Boston Med. and Surg. Journ., Oct. 28, 1909, 624.

————: "Die Messung des Fusses, seiner verschiedenen Formen und Deformitäten," Ztschr. f. orthop. Chir., Bd. 26, 1911, 156. Abstract: Zentralbl. f. chir. u. mech. Orthop., 1911, 122.

(13) Harris, J. R.: "Flat feet—the etiological relation of posture and gaits thereto." Military Surgeon, vol. 34, 1914, 1.

(14) Heiner, R. G.: "Flat foot and its relation to the Navy." U. S. Nav. Med. Bull., vol. 5, 1911, 451.

(15) Hoffmann, P.: "Conclusions drawn from a comparative study of the feet of barefooted and shoe-wearing peoples." Am. Jour. Orthop. Surg., vol. 3, Oct., 1905, 105.

————: "A statistical study of the relation between the height of the longitudinal arch and the function of the foot." Am. Med., vol. 13, Aug., 1907, 467.

(16) Holcomb, R. C.: "Weak foot." U. S. Nav. Med. Bull., vol. 7, July, 1913, 321.

(17) Hubscher: "Atrophy of the flexor longus hallucis in flat-foot." Ztschr. f. orthop. Chir., Bd. 17, 1907. Abstract: Am. Jour. Orthop. Surg., vol. 5, 1907, 264.

(18) Jones, A. S.: "Making the feet for military service." Military Surgeon, vol. 41, 1917, 219.

(19) Katzenstein, M.: "Induced hardening of ligaments cures flat foot." Deutsch. med. Wchnschr., Bd. 40, July 23, 1914, 537.

(20) Mebane, T. S.: "The foot problem." Military Surgeon, vol. 43, Oct., 1918, 377.

(21) Merrill, W. J.: "Causes, mechanism, and treatment of flat foot." Surg., Gynec. and Obst., vol. 22, 1916, 366.

(22) Muskat: "A new method of taking prints of the foot." Ztschr. f. ärztl. Fortbild., 1909, 3. Abstract: Am. Jour. Orthop. Surg., vol. 7, 1909, 279.

(23) Ogilvy: "Painful affections of the feet." Med. Rec., N. Y., Jan. 21, 1905.

(24) Quenu, E., and Kuss, G.: "A research on the anatomy and physiology of the foot." Abstract: Am. Jour. Orthop. Surg., vol. 8, May, 1911, 754.

(25) Richardson, G. H.: "The disabled foot in the military service and its diagnosis by the use of the skiagraph." Military Surgeon, vol. 23, 1908, 107.

(26) Rogers, J. F.: "The leverage of the foot." Anat. Rec., vol. 16, 1919, 317.

(27) Schüman: "Zur Methodik der Plattfussdiagnose." München. med. Wchnschr., Jan. 9, 1906, 81.

(28) Selter: "Flat-foot in child." Jahrb. f. Kinderh., N. F., vol. 57, 1900, H. 6. Abstract: Am. Jour. Orthop. Surg., vol. 2, 1904, 309.

(29) Smith, E. H.: "Arch defects of the human foot." Calif. State Jour. Med., vol. 16, 1918, 256.

(30) Spitzy, H.: "Pes planus." Ztschr. f. orthop. Chir., 12, 1904, H. 4. Abstract: Am. Jour. Orthop. Surg., vol. 2, 1904, 120.

(31) Tubby, A. H.: "The structure and functions of the foot." Jour. Roy. Army Med. Corps., vol. 19, 1912. Also, U. S. Nav. Med. Bull., vol. 6, 1912, 608.

————: "Deformities including diseases of the bones and joints" (second edition), vol. 1. London, 1912.

(32) United States. "Defects found in drafted men." War Department. (Compiled from the draft records.) 1920.

————: "Statistics—The medical department of the United States Army in the World War." Vol. 15, Part I, Army Anthropology, 1921.

(33) Walsham, W. J., and Hughes, W. K.: "Deformities of the human foot." New York, 1895.

(34) Weed, F. W.: "A study of the foot and foot wear." MILITARY SURGEON, vol. 30, 1912, 170.

(35) Weidenreich, Franz: "Der Menschenfuss." Stuttgart, 1921, 254.

(36) Whitman, R.: "Orthopedic Surgery" (sixth edition), 1920.

————: "A study of the weak foot." Tr. Am. Orthop. Assn., vol. 8.

————: "Observations on seventy-five cases of flat-foot." Tr. Am. Orthop. Assn., vol. 1, 1903.

(37) Williams, A. H.: "Static foot error in private practice." Am. Jour. Orthop. Surg., vol. 7, 1909, 481.

TABLE 1.—THE RELATION BETWEEN BODY WEIGHT AND THE LINEAR AND AREAL DETERMINATIONS UPON THE FOOT WHEN NOT SUBJECTED TO BODY WEIGHT.
(Group I.)

Range of body weight (lbs.)	No. of cases	Average body weight (lbs.)	Medial longitudinal length (cm.)	No. of cases	Average body weight (lbs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
						Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	......	....	....	2	110	8.5	7.2	3.7	16.4	15.3	11.3	10.4	3.5	5.6	20.9	28.4	6.0	60.9
120–130	2	127.0	12.0	4	126	9.5	8.2	4.5	19.7	17.9	13.5	11.7	3.7	6.6	26.0	48.9	10.6	92.0
130–140	10	134.2	12.6	26	133	9.3	7.9	4.1	19.4	17.8	13.0	12.1	3.2	5.9	26.1	38.2	9.7	79.8
140–150	32	144.9	12.8	44	144	9.7	8.1	4.4	19.8	18.2	13.0	12.1	4.3	7.7	28.4	41.4	11.0	88.1
150–160	16	154.2	13.3	28	153	10.1	8.6	4.5	20.6	18.5	13.2	12.1	4.1	7.8	30.5	46.5	12.1	95.9
160–170	12	163.7	12.9	22	163	9.7	8.3	4.4	20.0	18.5	13.0	12.5	4.5	8.0	27.9	45.0	11.3	92.1
170–180	9	174.0	13.7	11	173	10.0	8.4	4.8	21.2	19.2	13.8	12.3	4.7	8.5	31.2	44.5	14.8	99.0
180–190	0	....	....	0	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
190–200	0	....	....	2	192	10.0	7.8	5.0	18.8	16.3	12.7	11.8	1.5	1.5	21.1	51.8	11.2	85.6

TABLE 2.—THE RELATION BETWEEN BODY WEIGHT AND THE AREAL DETERMINATIONS OF THE FOOT WHEN SUBJECTED TO BODY WEIGHT. (GROUP I)

Range of body weight (lbs.)	No. of cases	Average body weight	Areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	2	110	5.7	11.3	25.8	45.8	9.6	92.4
120–130	4	126	7.5	12.5	30.2	72.2	14.8	129.4
130–140	26	133	6.5	12.1	32.0	59.0	14.1	117.4
140–150	44	144	7.2	12.8	33.7	61.8	15.0	123.4
150–160	28	153	7.1	13.0	35.4	65.6	16.7	131.0
160–170	22	163	8.4	14.4	34.4	66.3	16.4	131.6
170–180	11	173	7.9	13.8	37.9	68.8	19.4	139.8
180–190	......	....	.....	.....	....	....	....	......
190–200	2	192	8.4	13.5	33.6	79.5	18.5	145.6

TABLE 3.—The Relation Between Body Weight and the Linear and Areal Determinations of the Foot when Not Subjected to Body Weight

(Groups II and III.)

Range of body weight (lbs.)	No. of cases	Average body weight (lbs.)	Medial longitudinal length (cm.)	No. of cases	Average body weight (lbs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
						Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	2	119	11.2	2	119	9.6	7.2	3.5	18.2	16.9	11.3	10.5	3.2	7.1	32.4	19.6	9.8	68.7
120–130	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
130–140	12	137	12.4	12	137	9.5	7.6	3.8	19.2	17.5	12.6	11.3	2.9	5.5	28.6	37.6	9.8	81.4
140–150	12	143	13.1	12	143	9.9	8.0	4.2	20.3	18.6	13.0	11.8	3.8	6.6	31.5	38.6	12.9	89.8
150–160	6	154	12.9	6	154	9.6	7.3	4.3	20.1	18.7	12.8	12.1	3.7	6.2	30.6	31.3	11.9	79.9
160–170	4	162	12.6	4	162	10.2	8.4	4.9	20.6	19.4	12.6	12.3	3.2	6.7	35.1	39.9	16.2	97.9
170–180	2	174	13.2	2	174	11.0	8.5	5.0	22.1	20.5	13.3	12.6	5.0	9.7	36.4	51.0	20.1	117.1
180–190	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
190–200	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

TABLE 4.—The Relation Between Body Weight and the Areal Determinations of the Foot when Subjected to Body Weight. (Groups II and III.)

Range of body weight (lbs.)	No. of cases	Average body weight	Areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	2	118	6.2	11.1	37.2	45.2	15.2	108.7
120–130	......	......	......	......	......	......	......	......
130–140	12	137	6.1	9.2	33.5	60.3	14.9	117.7
140–150	12	143	6.8	10.6	38.0	63.5	17.5	129.6
150–160	6	154	6.0	9.6	36.9	48.5	15.7	110.7
160–170	4	162	7.0	11.2	40.0	58.2	19.8	129.3
170–180	2	174	7.4	14.6	42.8	63.0	23.9	144.2
180–190	......	......	......	......	......	......	......	......
190–200	......	......	......	......	......	......	......	......

TABLE 5.—THE RELATION BETWEEN BODY WEIGHT AND THE LINEAR AND AREAL MEASUREMENTS OF THE FOOT WHEN NOT SUBJECTED TO BODY WEIGHT.

(Groups I, II, and III.)

Range of body weight (lbs.)	No. of cases	Average body weight (lbs.)	Medial longitudinal length (cm.)	No. of cases	Average body weight (lbs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
						Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	2	119	11.2	4	114	9.0	7.2	3.6	17.3	16.1	11.3	10.4	3.4	6.3	26.6	24.0	7.9	64.8
120–130	2	127	12.0	4	126	9.5	8.2	4.5	19.7	17.9	13.5	11.7	3.7	6.6	26.0	48.9	10.6	92.0
130–140	22	136	12.5	38	134	9.4	7.8	4.0	19.4	17.7	12.8	11.9	3.1	5.8	26.9	38.0	9.7	80.4
140–150	44	145	12.9	56	144	9.8	8.1	4.3	19.8	18.3	13.0	12.1	4.2	7.5	29.1	40.8	11.4	88.5
150–160	22	154	13.2	34	154	10.0	8.3	4.5	20.3	18.6	13.2	12.1	4.0	7.5	30.5	43.6	12.1	93.1
160–170	16	163	12.8	26	163	9.8	8.3	4.5	20.1	18.6	12.9	12.5	4.3	7.8	29.0	44.2	12.1	93.0
170–180	11	174	13.7	13	173	10.2	8.4	4.8	21.3	19.4	13.8	12.3	4.7	8.7	32.0	45.6	15.5	101.8
180–190	......	....	....	......	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
190–200	......	....	....	2	192	10.0	7.8	5.0	18.8	16.3	12.7	11.8	1.5	1.5	21.1	51.8	11.2	85.6

TABLE 6.—THE RELATION BETWEEN BODY WEIGHT AND THE AREAL DETERMINATIONS OF THE FOOT WHEN SUBJECTED TO BODY WEIGHT.
(GROUPS I, II, AND III.)

Range of body weight (lbs.)	No. of cases	Average body weight	Areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	4	114	6.0	11.2	31.5	45.5	12.6	100.6
120–130	4	126	7.5	12.5	30.2	72.2	14.8	129.4
130–140	38	134	6.4	11.2	32.4	59.4	14.4	117.5
140–150	56	144	7.2	12.4	34.6	62.2	15.6	124.7
150–160	34	154	6.9	12.2	35.7	62.6	16.6	127.4
160–170	26	163	8.2	14.0	35.3	65.0	16.9	131.3
170–180	13	173	7.8	13.9	38.6	67.8	20.0	140.4
180–190	.....	....	.....	.....	....	....	....	......
190–200	2	192	8.4	13.5	33.6	79.5	18.5	145.6

TABLE 7.—The Relation Between Body Weight and the Linear and Areal Determinations of the Foot when not Subjected to Body Weight.

(Groups IV, V and VI.)

Range of body weight (lbs.)	No. of cases	Average body weight (lbs.)	Medial longitudinal length (cm.)	No. of cases	Average body weight (lbs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
						Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
120–130	2	127	11.4	2	127	8.6	7.1	3.5	17.9	16.5	11.5	11.2	4.6	8.3	26.9	31.1	6.3	72.5
130–140	8	134	12.0	8	134	9.5	7.8	3.7	18.9	17.3	12.0	11.2	3.7	6.7	27.9	35.2	9.8	79.6
140–150	4	147	12.7	4	147	10.0	7.8	4.2	19.1	17.7	12.7	12.1	4.7	8.3	27.4	34.8	9.2	79.6
150–160	12	155	12.9	12	155	9.9	8.4	4.1	20.3	18.8	12.7	12.5	4.5	8.4	22.9	45.9	11.3	96.8
160–170	2	160	11.9	4	160	10.0	7.4	4.3	20.3	18.2	13.2	12.2	3.6	6.9	27.3	47.1	12.6	93.9
170–180	7	173	14.0	7	173	9.9	8.4	4.6	20.6	18.7	13.9	12.3	4.1	7.6	28.1	55.2	13.6	104.5
180–190	2	184	13.1	2	184	9.4	8.1	3.8	19.4	17.5	13.2	12.0	2.0	4.6	23.8	28.9	10.3	67.6
190–200	2	198	13.6	2	198	10.0	8.4	4.7	20.9	19.0	13.7	13.1	2.2	5.7	29.3	48.5	12.1	95.4

TABLE 8.—The Relation Between Body Weight and the Areal Determinations of the Foot when Subjected to Body Weight.

(Groups IV, V, and VI.)

Range of body weight (lbs.)	No. of cases	Average body weight	Areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	...	...	...	...	...	...	...	...
120–130	2	127	5.9	10.1	31.3	53.3	12.2	106.9
130–140	8	134	7.3	11.8	33.0	63.3	16.4	124.0
140–150	4	147	8.9	16.0	35.4	69.0	13.8	134.3
150–160	12	155	8.4	13.8	36.5	73.4	18.2	142.0
160–170	4	160	7.8	16.1	33.9	70.0	17.8	137.8
170–180	7	173	7.9	12.2	34.1	83.0	18.0	147.4
180–190	2	184	8.1	14.7	32.5	55.2	15.4	117.7
190–200	2	198	6.5	13.0	34.2	71.3	17.6	136.1

TABLE 9.—THE RELATION BETWEEN BODY WEIGHT AND THE LINEAR AND AREAL DETERMINATIONS OF THE FOOT WHEN NOT SUBJECTED TO BODY WEIGHT

(Groups I, II, III, IV, V and VI)

Range of body weight (lbs.)	No. of cases	Average body weight (lbs.)	Medial longitudinal length (cm.)	No. of cases	Average body weight (lbs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
						Bimetatarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	2	119	11.2	4	114	9.0	7.2	3.6	17.3	16.1	11.3	10.4	3.4	6.3	26.6	24.0	7.9	64.8
120–130	4	127	11.7	6	126	9.2	7.8	4.2	19.2	17.4	12.8	11.6	4.0	7.2	26.2	42.8	9.2	85.5
130–140	30	135	12.4	46	134	9.4	7.8	4.0	19.3	17.6	12.7	11.8	3.2	5.9	27.1	37.5	9.7	80.3
140–150	48	145	12.9	60	144	9.5	8.1	4.3	19.8	18.2	13.0	12.1	4.2	7.5	28.9	40.4	11.3	87.9
150–160	34	154	13.1	46	154	10.0	8.4	4.4	20.3	18.6	13.1	12.2	4.1	7.8	30.7	44.2	11.9	94.1
160–170	20	163	14.3	30	163	9.8	8.2	4.5	20.1	18.6	12.9	12.4	4.2	7.7	28.8	44.6	12.1	93.2
170–180	18	174	13.8	20	173	10.1	8.4	4.8	21.1	19.2	13.8	12.3	4.5	8.3	30.6	48.9	14.9	102.8
180–190	2	184	13.1	2	184	9.4	8.1	3.8	19.4	17.5	13.2	12.0	2.0	4.6	23.8	28.9	10.3	67.6
190–200	2	198	13.6	4	195	9.5	8.1	4.8	19.9	17.6	13.2	12.4	1.9	3.6	25.2	50.1	11.6	90.5

TABLE 10.—THE RELATION BETWEEN BODY WEIGHT AND THE AREAL DETERMINATIONS OF THE FOOT, WHEN SUBJECTED TO BODY WEIGHT

(Groups I, II, III, IV, V, and VI)

Range of body weight (lbs.)	No. of cases	Average body weight	Areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	4	114	6.0	11.2	31.5	45.5	12.6	100.6
120–130	6	126	7.0	11.7	30.4	65.9	13.9	121.9
130–140	46	134	6.6	11.3	32.6	60.0	14.7	118.6
140–150	60	144	7.2	12.6	34.7	62.6	15.4	125.4
150–160	46	154	7.2	12.8	36.0	65.5	17.0	131.2
160–170	30	163	8.1	14.3	35.1	65.7	17.0	132.2
170–180	20	173	7.8	13.3	37.0	73.2	19.4	142.9
180–190	2	184	8.1	14.7	32.5	55.2	15.4	117.7
190–200	4	195	7.4	13.3	34.0	75.4	18.3	140.9

TABLE 11.—The Relation between Body Weight and the Absolute Increments in the Areal Determinations of the Foot, when Subjected to Body Weight

(Groups I, II, III, IV, V and VI)

Range of body weight (lbs.)	No. of cases	Average body weight	Differences between areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
110–120	21	114	2.6	5.0	4.9	21.5	4.8	35.8
120–130	6	126	3.0	4.6	4.2	23.0	4.8	36.4
130–140	46	134	3.4	5.4	5.5	22.5	5.0	38.4
140–150	60	144	3.0	5.0	5.8	22.2	4.2	37.5
150–160	46	154	3.1	5.0	5.3	21.3	5.1	37.1
160–170	30	163	3.9	6.6	6.4	21.1	4.9	39.0
170–180	20	173	3.3	5.0	6.4	24.2	4.4	40.1
180–190	2	184	6.2	10.2	8.7	26.2	5.0	50.2
190–200	1	195	5.6	9.7	8.8	25.3	6.7	50.4

TABLE 12.—The Relation between Body Weight and the Force, the Distribution of Force, and the Stress on the Foot when Subjected to Body Weight

Range of body weight (lbs.)	Average weight causing increment	No. of cases	Anterior area			Middle area			Posterior area			Total calc. area increment, sq. cm.
			Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	
110–120	114.3	21	18.0	15.7	0.57	78.9	69.0	1.73	17.4	15.3	1.38	31.2
120–130	126.3	6	16.6	13.1	0.55	91.0	72.0	1.38	18.8	14.9	1.35	32.0
130–140	134.0	46	22.2	16.6	0.68	91.6	68.3	1.52	20.2	15.1	1.38	32.9
140–150	144.4	60	25.8	17.9	0.74	99.8	69.1	1.59	18.8	13.0	1.21	32.2
150–160	153.8	46	25.7	16.7	0.71	103.3	67.2	1.58	24.8	16.1	1.46	31.6
160–170	162.8	30	32.0	19.6	0.91	106.4	65.3	1.62	24.5	15.0	1.44	32.3
170–180	173.2	20	31.6	18.3	0.85	119.6	69.1	1.64	21.9	12.7	1.13	35.1
180–190	184.0	2	40.0	21.8	1.23	120.8	65.6	2.19	23.2	12.6	1.51	40.0
190–200	195.0	4	42.1	21.6	1.24	121.0	62.0	1.60	31.9	16.4	1.74	40.7

TABLE 13.—THE RELATION BETWEEN AGE AND THE LINEAR AND AREAL DETERMINATIONS OF THE NORMAL FOOT WHEN NOT SUBJECTED TO THE BODY WEIGHT

Range of age (yrs.)	No. of cases	Average body weight (lbs.)	Average age (yrs.)	Linear measurements (cm.)							Areal determinations (sq. cm.)					
				Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
16–19	11	144	17.6	9.6	8.1	4.6	19.8	18.4	13.1	12.3	4.2	7.5	27.4	49.4	11.4	95.7
19–22	30	150	19.4	9.8	8.3	4.4	19.8	18.2	13.0	12.2	3.8	7.2	27.6	42.7	11.6	89.0
22–25	16	151	22.8	9.7	8.0	4.1	19.8	18.3	13.2	12.2	3.9	7.0	28.7	41.5	10.4	87.7
25–28	6	156	25.5	9.9	8.4	4.5	20.2	18.3	13.3	12.4	4.9	8.4	29.1	37.8	11.3	84.2
28–31	3	149	29.3	9.9	8.5	4.5	20.1	18.2	13.0	11.9	4.8	7.9	31.4	42.1	11.2	92.6
31–34	3	151	33.0	9.8	8.0	4.1	20.0	18.2	13.2	11.8	4.8	7.8	30.2	35.1	10.5	83.6

TABLE 14.—THE RELATION BETWEEN AGE AND THE INCIDENCE OF FLAT FOOT

Range of age (yrs.)	Number of cases (absolute)				Number of cases (per cent of total)			
	Walsham and Hughes	Blodgett	Whitman	Williams	Walsham and Hughes	Blodgett	Whitman	Williams
0–10	103	....	98	....	9.6	....	9.8	....
0–12	168	....	....	6	15.6	....	....	2.0
10–15	328	....	199	....	30.4	....	19.9	....
15–20	323	....	227	....	30.0	....	22.7	....
10–20	651	....	426	....	60.4	....	42.6	....
12–20	586	166	....	34	54.4	17.0	....	11.5
20–25	98	....	147	....	9.1	....	14.7	....
25–30	67	....	109	....	6.2	....	10.9	....
20–30	165	260	256	75	15.3	26.6	25.6	25.0
Over 30	159	548	220	185	14.8	56.4	22.0	61.5
30–40	68	234	....	59	6.3	24.1	....	19.5
40–50	30	181	....	56	2.8	18.6	....	18.5
50–60	11	96	....	47	1.0	9.9	....	15.6
Over 60	50	37	....	23	4.6	3.8	....	8.0
60–70	....	35	....	14	....	3.6	....	5.0
70–80	....	2	....	9	....	0.2	....	2.9
Total No. of cases..	1,078	974	1,000	3,000	....	....	....	....

TABLE 15.—THE RELATION OF THE ARCH HEIGHT TO THE ABSOLUTE AREAL DETERMINATIONS OF THE NORMAL FOOT WHEN SUBJECTED AND WHEN NOT SUBJECTED TO BODY WEIGHT

Range of arch height (cm.)	Average arch height (cm.)	Average body weight pounds	No. of cases	All toes (sq. cm.)		Anterior (sq. cm.)		Middle (sq. cm.)		Posterior (sq. cm.)		Total (sq. cm.)	
				Without body weight	With body weight	Without body weight	With body weight	Without body weight	With body weight	Without body weight	With body weight	Without body weight	With body weight
2.6–3.0	2.8	169	4	8.4	11.6	31.5	36.4	43.3	71.4	14.9	19.2	98.2	138.6
3.0–3.4	3.3	132	1	10.9	11.7	30.0	33.4	48.0	67.3	14.7	20.7	103.6	133.1
3.4–3.8	3.7	138	10	6.7	11.4	27.8	32.9	42.8	64.7	11.8	15.9	89.2	124.9
3.8–4.2	4.0	147	42	7.0	12.5	28.6	34.2	44.1	65.8	11.2	15.8	90.9	128.2
4.2–4.6	4.4	148	29	7.4	13.3	28.7	34.1	41.2	62.5	10.6	15.2	88.0	125.2
4.6–5.0	4.7	150	27	7.3	13.1	27.4	33.3	41.4	60.8	10.8	15.7	86.9	123.0
5.0–5.4	5.1	155	22	8.2	14.6	28.0	34.7	43.2	62.5	11.0	15.6	90.3	127.4
5.4–5.8	5.4	178	2	5.6	16.8	23.1	34.0	37.6	65.7	11.6	18.4	77.9	134.8

TABLE 16.—THE RELATION OF THE ARCH HEIGHT TO THE PERCENTAGE INCREASE IN THE AREAL DETERMINATIONS OF THE NORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Arch height range (cm.)	Average arch height (cm.)	Average body weight (lbs.)	Number of cases	All toes per cent	Anterior per cent	Middle per cent	Posterior per cent	Total per cent
2.6–3.0	2.8	169	4	26.0	13.3	39.3	21.7	29.1
3.0–3.4	3.3	132	1	6.8	10.2	28.7	29.0	22.2
3.4–3.8	3.7	138	10	39.4	15.4	34.2	26.0	28.6
3.8–4.2	4.0	147	42	42.5	15.7	33.7	30.9	29.6
4.2–4.6	4.4	148	29	43.4	15.9	34.8	31.8	30.2
4.6–5.0	4.7	150	27	43.2	17.6	32.1	32.7	29.5
5.0–5.4	5.1	155	22	43.0	19.1	31.2	29.5	29.1
5.4–5.8	5.4	178	2	67.2	32.4	44.6	35.7	41.5

TABLE 17.—THE RELATION OF THE ARCH HEIGHT TO THE ABSOLUTE INCREMENTS IN THE AREAL DETERMINATIONS OF THE NORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Arch height range (cm.)	Average arch height (cm.)	Average body weight (lbs.)	No. of cases	All toes (sq. cm.)	Anterior (sq. cm.)	Middle (sq. cm.)	Posterior (sq. cm.)	Total (sq.cm.)
2.6–3.0	2.8	169	4	3.2	4.9	28.1	4.3	40.4
3.0–3.4	3.3	132	1	0.8	3.4	19.3	6.0	29.5
3.4–3.8	3.7	138	10	4.7	5.1	21.9	4.1	35.7
3.8–4.2	4.0	147	42	5.5	5.6	21.7	4.6	37.3
4.2–4.6	4.4	148	29	5.9	5.4	21.3	4.6	37.2
4.6–5.0	4.7	150	27	5.8	5.9	19.4	4.9	36.1
5.0–5.4	5.1	155	22	6.4	6.7	19.3	4.6	37.1
5.4–5.8	5.4	178	2	11.2	10.9	28.1	6.8	56.9

TABLE 18.—THE RELATION OF ARCH HEIGHT TO THE FORCE, THE DISTRIBUTION OF FORCE, AND THE STRESS ON THE NORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Range	Average arch height (cm.)	Average body weight (lbs.)	No. of cases	Anterior			Middle			Posterior			Calc. total increment in area
				Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	Force (lbs.)	Per cent of total force	Stress pounds sq. cm.	
2.6–3.0	2.8	169	4	22.2	13.1	0.61	127.3	75.3	1.78	19.5	11.5	1.02	37.3
3.0–3.4	3.3	132	1	15.6	11.8	0.47	88.8	67.2	1.32	27.6	20.9	1.33	28.7
3.4–3.8	3.7	138	10	22.6	16.4	0.68	97.2	70.5	1.50	18.2	13.2	1.15	31.1
3.8–4.2	4.0	147	42	25.8	17.6	0.75	99.8	68.0	1.52	21.2	14.4	1.34	31.9
4.2–4.6	4.4	148	29	25.5	17.3	0.75	100.7	68.1	1.61	21.8	14.7	1.43	31.3
4.6–5.0	4.7	150	27	29.3	19.5	0.88	96.4	64.2	1.59	24.4	16.2	1.55	30.2
5.0–5.4	5.1	155	22	33.9	21.9	0.98	97.8	63.1	1.56	23.3	15.0	1.49	30.6
5.4–5.8	5.4	178	2	42.5	23.8	1.25	109.5	61.3	1.67	26.5	14.8	1.44	45.8

TABLE 19.—The Calculated Depression of the Arch Height in the Normal and Abnormal Foot when Subjected to Body Weight

Group	Body weight (lbs.)	No. of cases	Medial arch length (cm.)		Arch height (cm.)		Depression of arch	
			Without body weight	With body weight	Observed without body weight	Calculated with body weight	Absolute (cm.)	Per cent of original length
I(a)	146	58	13.09	13.43	4.47	3.75	0.72	16.15
I(b)	151	81	13.04	13.34	4.26	3.60	0.66	15.50
I	149	139	13.06	13.35	4.35	3.73	0.62	14.30
II	148	20	12.92	13.10	4.27	3.90	0.37	8.76
III	143	18	12.50	12.80	4.27	3.66	0.61	14.35
IV	·154	25	12.88	13.36	4.11	2.94	1.17	28.48
V	159	14	13.04	13.67	4.25	0.83	3.42	80.40
VI	160	2	11.80	12.10	4.00	3.40	0.60	15.03

TABLE 20.—Calculated Depression of Normal and Moderately Pathologic Flat Arches when Subjected to Additional Loads

(a)

Weight upon normal arch	No. of cases	Arch height in normal feet		Weight on moderately pathologic flat arch	No. of cases	Arch height in moderately pathologic feet	
		Absolute (cm.)	Depression of resting arch height (per cent)			Absolute (cm.)	Depression of resting arch height (per cent)
11.0	58	4.47	....	11.0	2	3.35	....
146.4	58	3.99	10.78	160.0	2	2.86	14.63
178.4	58	3.81	14.83	192.0	2	2.68	20.15
210.4	58	3.63	18.77	224.0	2	2.48	26.12

(b)

Weight upon normal arch	No. of cases	Arch height in normal feet			No. of cases	Arch height in moderately pathologic feet		
		Absolute (cm.)	Depression (cm.)	Depression (per cent)		Absolute (cm.)	Depression (cm.)	Depression (per cent)
Body weight	58	3.99	....	....	2	2.86	....	....
+32 lbs....	58	3.81	0.181	4.54	2	2.68	0.185	6.47
+64 lbs....	58	3.63	0.357	8.96	2	2.48	0.385	13.46

TABLE 21.—AVERAGE ABSOLUTE CHANGE IN THE LINEAR AND AREAL DETERMINATIONS OF THE NORMAL FOOT WHEN SUBJECTED TO INCREASING LOADS

Weight upon foot (lbs.)	No. of cases	Linear measurements (cm.)								Areal determinations (sq. cm.)					
		Heel toe	Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
11.0	58	26.0	9.6	8.3	4.6	19.8	18.2	13.1	12.2	3.8	7.1	27.3	46.2	11.5	92.1
146.4	58	26.3	10.2	9.1	5.6	20.8	18.9	13.3	12.3	7.8	14.4	34.1	65.7	15.7	129.0
178.4	58	26.4	10.2	9.2	5.7	20.9	19.0	13.4	12.3	8.1	15.2	34.4	68.5	16.1	134.2
210.4	58	26.6	10.3	9.3	5.8	21.1	19.1	13.5	12.4	8.9	16.3	35.2	70.5	16.6	138.8

TABLE 22.—AVERAGE ABSOLUTE CHANGE IN THE LINEAR AND AREAL DETERMINATIONS OF THE MODERATELY PATHOLOGIC FLAT FOOT WHEN SUBJECTED TO INCREASING LOADS

Weight upon foot (lbs.)	No. of cases	Linear measurements (cm.)								Areal determinations (sq. cm.)					
		Heel toe	Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
11.0	2	28.4	10.0	8.3	5.0	21.6	19.2	14.6	12.7	4.9	5.8	26.4	74.3	14.1	120.5
160.0	2	28.7	10.5	9.5	5.9	22.8	20.4	14.8	12.9	11.4	19.5	33.6	94.6	19.4	167.0
192.0	2	28.9	10.7	9.5	6.0	22.7	20.3	14.8	12.9	10.4	17.9	34.9	97.5	19.4	169.6
224.0	2	28.9	10.7	9.8	6.0	22.8	20.4	14.9	12.9	11.2	19.2	35.8	99.1	20.3	174.4

TABLE 23.—Average Percentage Change in the Linear and Areal Determinations of the Normal Foot when Subjected to Increasing Loads

Weight upon foot (lbs.)	No. of cases	Linear measurements (cm.)								Areal determinations (sq. cm.)					
		Heel toe	Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
146.4	58	1.8	4.5	9.0	18.2	4.9	4.0	1.9	0.6	47.9	51.1	20.9	30.2	27.1	29.5
178.1	58	1.9	4.8	9.8	19.7	5.4	4.3	2.4	0.9	52.4	53.4	21.1	33.1	28.7	31.8
210.4	58	2.1	5.1	10.1	19.9	5.6	4.4	2.9	1.1	56.8	57.1	21.7	33.6	29.4	33.1

TABLE 24.—Average Percentage Change in the Linear and Areal Determinations of the Moderately Pathologic Flat Foot when Subjected to Increasing Loads

Weight upon foot (lbs.)	No. of cases	Linear measurements (cm.)								Areal determinations (sq. cm.)					
		Heel toe	Bimeta-tarsal	Anterior diameter	Posterior diameter	Long axis	Short axis	Medial arch	Lateral arch	Great toe	All toes	Anterior	Middle	Posterior	Total
160	2	0.9	4.9	12.7	16.1	5.1	5.7	1.0	1.2	57.0	70.1	21.4	21.5	27.2	27.9
192	2	1.5	6.1	12.7	17.5	4.8	5.2	1.4	1.6	54.4	67.5	24.4	23.8	27.4	29.0
224	2	1.5	6.1	14.9	17.5	5.3	5.7	1.7	1.2	56.2	69.6	26.9	25.0	30.6	30.8

TABLE 25.—Absolute Increments of the Areal Determinations of the Normal Foot when Subjected to Increasing Loads

Average weight upon foot (lbs.)	Number of cases	Differences between areal determinations (sq. cm.)					
		Great toe	All toes	Anterior	Middle	Posterior	Total
146.4	58	3.96	7.32	6.84	19.55	4.23	36.89
178.4	58	0.34	0.82	0.29	2.75	0.36	5.18
210.4	58	0.73	1.12	0.82	2.03	0.48	4.57

TABLE 26.—The Force, the Distribution of Force and the Stress upon the Normal Foot when Subjected to Increasing Loads

Average body weight causing increment in area (lbs.)	Number of cases	Anterior area			Middle area			Posterior area			Calculated total increment in area (sq. cm.)
		Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	
146	58	32.7	22.3	0.96	93.5	63.8	1.42	20.2	13.8	1.29	30.6
32	58	2.7	8.5	....	25.9	80.9	....	3.4	10.6	....	3.4
64	58	10.0	16.5	....	45.4	70.9	....	8.0	12.5	....	6.7
178	58	37.4	21.0	1.09	116.9	65.6	1.71	24.1	13.5	1.50	34.0
210	58	44.8	21.3	1.27	137.1	65.1	1.94	28.6	13.6	1.72	37.4

TABLE 27.—Absolute Increments of the Areal Determinations of the Moderately Pathologic Flat Foot when Subjected to Increasing Loads

Average weight upon foot (lbs.)	Number of cases	Differences between areal determinations (sq. cm.)					
		Great toe	All toes	Anterior	Middle	Posterior	Total
160	2	6.51	13.65	7.25	20.35	5.25	46.50
192	2	—0.71	—1.60	1.25	2.85	0.05	2.55
224	2	0.50	1.30	0.95	1.65	0.90	4.80

TABLE 28.—The Force, the Distribution of Force and the Stress upon the Moderately Pathologic Flat Foot when Subjected to Increasing Loads

Average body weight causing increment in area (lbs.)	Number of cases	Anterior area			Middle area			Posterior area			Calculated total increment in area (sq. cm.)
		Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	
160	2	35.3	22.1	1.05	99.1	61.9	1.05	25.6	16.0	1.32	32.9
32	2	9.6	30.1	....	22.0	68.7	....	0.4	1.2	....	4.2
64	2	18.3	28.6	....	37.1	57.9	....	8.6	13.5	....	7.7
192	2	45.0	23.4	1.29	121.1	63.1	1.20	26.0	13.5	1.34	37.0
224	2	53.6	24.0	1.50	136.2	60.8	1.37	34.2	15.3	1.68	40.5

TABLE 29.—AVERAGE ABSOLUTE LINEAR MEASUREMENTS OF THE NORMAL AND ABNORMAL FOOT WHEN NOT SUBJECTED TO BODY WEIGHT (CM.)

Group	No. of cases		Heel-toe length		Medial longitudinal		Bimeta-tarsal		Anterior diameter		Posterior diameter		Long axis		Short axis		Medial arch		Lateral arch	
	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(a)........	29	29	26.0	26.0	......	......	9.8	9.4	8.3	8.3	4.6	4.6	19.8	19.8	18.1	18.2	13.0	13.2	12.1	12.4
I(b)........	40	41	......	......	12.9	13.1	9.7	9.7	8.0	8.2	4.1	4.3	19.9	20.0	18.2	18.4	12.9	13.2	12.1	12.1
II..........	10	10	......	......	12.9	12.9	9.8	9.9	7.8	8.1	4.2	4.3	20.2	20.2	18.5	18.6	12.9	13.0	12.0	11.7
III..........	9	9	......	......	12.4	12.6	9.8	9.9	7.4	7.8	4.1	4.2	19.5	19.6	18.1	18.1	12.4	12.6	11.8	11.4
IV..........	13	12	......	......	12.8	13.0	9.7	9.6	8.2	8.2	4.2	4.2	20.1	19.9	18.5	18.4	12.8	13.0	12.4	12.1
V..........	7	7	28.3	28.6	12.8	12.8	9.9	9.8	8.2	7.9	4.1	3.8	19.6	19.5	17.6	17.9	13.0	13.1	11.7	11.9
			(1 c	ase)	(6 c	ases)														
VI..........	1	1	......	......	12.0	11.8	9.9	10.0	6.3	6.7	3.9	3.5	18.4	19.5	16.8	17.4	11.9	11.7	11.4	11.6

TABLE 30.—AVERAGE ABSOLUTE LINEAR MEASUREMENTS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT (CM.)

Group	No. of cases		Heel-toe length		Medial longitudinal		Bimeta-tarsal		Anterior diameter		Posterior diameter		Long axis		Short axis		Medial arch		Lateral arch	
	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(a).......	29	29	26.5	26.1	......	......	10.2	10.1	9.2	9.1	5.7	5.5	20.8	20.8	18.9	18.9	13.3	13.4	12.2	12.4
I(b).......	40	41	......	......	13.1	13.4	10.1	10.1	8.9	9.0	5.4	5.5	20.9	20.9	18.9	19.1	13.2	13.5	12.2	12.1
II..........	10	10	......	......	13.1	13.2	10.2	10.3	8.6	8.9	5.1	5.4	21.1	21.1	19.2	19.3	13.0	13.2	12.1	11.7
III..........	9	9	......	......	12.7	12.7	10.3	10.4	8.6	8.9	5.3	5.4	20.6	20.5	18.9	18.7	12.7	12.9	11.9	11.4
IV..........	13	12	......	......	13.3	13.3	10.2	10.1	9.1	9.2	5.6	5.7	21.3	21.1	19.3	19.3	13.3	13.5	12.4	12.2
V..........	7	7	28.6	28.9	13.5	13.1	10.5	10.4	9.3	9.3	5.6	5.5	20.8	20.8	18.8	18.7	13.7	13.6	11.9	12.0
			(1 c	ase)	(6 ca	ses)														
VI..........	1	1	......	......	12.1	11.9	10.1	10.0	8.1	8.3	5.4	5.5	19.6	20.0	17.4	17.7	12.1	12.1	11.4	11.7

TABLE 31.—AVERAGE PERCENTAGE CHANGE OF THE LINEAR MEASUREMENTS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Group	No. of cases		Heel-toe length		Medial longitudinal		Bimeta-tarsal		Anterior diameter		Posterior diameter		Long axis		Short axis		Medial arch		Lateral arch	
	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(*a*)	29	29	2.0	1.7	......	......	4.9	4.1	9.0	9.0	18.7	17.8	5.0	4.7	4.4	3.6	2.0	1.8	0.7	0.4
I(*b*)	40	41	......	......	2.0	1.8	4.4	3.7	9.5	8.6	23.2	21.8	5.1	4.4	3.9	3.7	2.6	2.1	0.6	0.5
II	10	10	......	......	1.5	1.7	3.9	3.8	9.8	9.8	18.3	20.8	4.5	4.4	3.6	3.7	1.3	1.4	0.5	0.5
III	9	9	......	......	2.2	2.5	4.8	4.7	13.5	12.3	22.2	23.0	5.4	4.5	3.9	3.2	2.1	2.6	0.1	0.4
IV	13	12	......	......	3.2	2.4	4.9	5.0	10.0	10.4	24.6	25.0	6.1	5.1	4.3	4.9	3.7	3.5	0.4	0.6
V	7	7	1.0	0.9	3.6	2.9	5.7	4.9	12.0	15.2	26.7	31.2	5.9	6.5	5.9	4.7	4.1	3.8	1.1	0.7
			(1 case)		(6 cases)															
VI	1	1	......	......	0.4	0.4	1.5	0.0	22.2	19.3	27.8	36.4	6.1	2.5	3.5	1.7	1.7	3.3	0.0	0.9

TABLE 32.—AVERAGE ABSOLUTE AREAL DETERMINATIONS OF THE NORMAL AND ABNORMAL FOOT WHEN NOT SUBJECTED TO BODY WEIGHT (SQ. CM.)

Group	No. of cases		Age (yrs.)	Arch height (cm.)		Body length (inches)	Body weight (lbs.)	Areal determinations (sq. cm.)											
								Great toe		All toes		Anterior		Middle		Posterior		Total	
	R.	L.		R.	L.			R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(*a*)	29	29	19.2	4.5	4.5	68.1	146	3.8	3.9	6.8	7.3	27.3	27.2	45.7	46.6	11.7	11.3	91.6	92.7
I(*b*)	40	41	23.3	4.3	4.2	67.8	151	4.0	4.4	7.3	7.9	28.4	29.3	40.2	40.0	10.3	11.1	86.3	88.3
II	10	10	25.8	4.3	4.2	67.1	148	3.6	4.2	6.9	7.2	31.2	32.4	41.2	42.1	12.0	12.9	91.3	94.6
III	9	9	23.7	4.3	4.2	66.6	143	2.9	3.1	5.7	5.7	29.0	31.7	31.3	33.0	11.5	12.8	77.5	82.5
IV	13	12	24.1	4.1	4.1	66.8	154	4.2	4.5	8.2	8.0	29.4	29.1	44.2	45.3	11.7	11.0	93.9	93.4
V	7	7	24.0	4.3	4.2	67.1	159	3.4	4.1	5.6	6.8	27.3	27.9	44.2	42.2	11.3	9.7	88.4	86.6
VI	1	1	....	4.0	4.0	68.0	160	2.3	2.2	7.5	8.5	25.5	30.8	20.7	19.2	10.6	11.7	64.3	70.2

TABLE 33.—AVERAGE ABSOLUTE AREAL DETERMINATIONS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT (SQ. C.M.)

Group	No. of cases		Age (yrs.)	Arch height (cm.)		Body length (inches)	Body weight (lbs.)	Areal determinations (sq. cm.)											
								Great toe		All toes		Anterior		Middle		Posterior		Total	
	R.	L.		R.	L.			R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(a)........	29	29	19.2	4.5	4.5	68.1	146	8.2	7.5	14.7	14.1	34.5	33.8	65.6	65.9	16.3	15.1	129.2	129.8
I(b)........	40	41	23.3	4.3	4.2	67.8	151	6.9	7.0	12.2	11.9	34.0	33.8	62.0	62.3	15.4	16.1	123.6	124.2
II...........	10	10	25.8	4.3	4.2	67.1	148	7.4	6.4	12.6	10.1	36.8	37.2	60.3	61.8	16.2	17.8	125.9	126.7
III...........	9	9	23.7	4.3	4.2	66.6	143	6.6	5.5	10.1	8.2	36.7	36.4	54.7	56.9	16.0	17.4	117.6	119.0
IV...........	13	12	24.1	4.1	4.1	66.8	154	8.3	7.8	14.0	12.4	34.8	34.3	71.8	73.8	17.2	17.3	137.8	137.1
V...........	7	7	24.0	4.3	4.2	67.1	159	8.0	8.1	13.8	13.4	34.0	34.9	69.5	70.8	16.7	16.0	134.1	135.1
VI...........	1	1	....	4.0	4.0	68.0	160	4.3	4.1	11.2	14.2	32.8	35.8	41.1	50.0	15.8	16.6	100.9	116.6

TABLE 34.—AVERAGE PERCENTAGE CHANGE OF THE AREAL DETERMINATIONS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Group	No. of cases		Age (yrs.)	Arch height (cm.)		Body length (inches)	Body weight (lbs.)	Areal determinations (sq. cm.)											
								Great toe		All toes		Anterior		Middle		Posterior		Total	
	R.	L.		R.	L.			R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
I(a)........	29	29	19.2	4.5	4.5	68.1	146	51.4	44.4	53.5	48.7	20.2	21.6	30.8	29.7	28.3	25.8	30.2	28.7
I(b)........	40	41	23.3	4.3	4.2	67.8	151	39.9	34.2	39.4	32.7	16.2	13.1	36.0	36.3	33.9	32.6	30.4	29.1
II...........	10	10	25.8	4.3	4.2	67.1	148	51.3	30.5	45.0	27.5	15.2	12.8	31.6	32.3	26.2	28.5	27.4	25.5
III...........	9	9	23.7	4.3	4.2	66.6	143	56.5	41.5	41.5	26.4	21.2	13.1	43.2	42.3	28.9	27.8	34.0	30.6
IV...........	13	12	24.1	4.1	4.1	66.8	154	40.4	41.5	40.7	34.0	15.4	15.2	38.7	37.9	32.5	36.3	32.3	31.9
V...........	7	7	24.0	4.3	4.2	67.1	159	51.2	51.7	52.4	45.3	19.8	20.0	38.6	41.8	33.7	41.9	35.0	36.3
VI...........	1	1	....	4.0	4.0	68.0	160	46.5	46.4	33.1	40.1	22.2	14.0	49.6	61.6	32.9	29.6	36.6	39.8

TABLE 35.—Average Absolute Linear and Areal Determinations of the Normal and Abnormal Foot when not Supporting the Body Weight

Group	No. of cases	Aver. age (yrs.)	Aver. arch height (cm.)	Aver. body length (in.)	Aver. body weight (lbs.)	Linear measurements (cm.)								Areal determinations (sq. cm.)					
						Medial longitudinal	Bimetatarsal	Anterior diam.	Posterior diam.	Long axis	Short axis	Medial	Lateral	Big toe	All toes	Anterior	Middle	Posterior	Total
I(a)	58	19.2	4.5	68.1	146	....	9.6	8.3	4.6	19.8	18.2	13.1	12.2	3.8	7.1	27.3	46.2	11.5	92.1
I(b)	81	23.2	4.3	67.8	151	13.0	9.7	8.1	4.2	20.0	18.3	13.0	12.1	4.2	7.6	28.9	40.0	10.7	87.3
I	39	21.6	4.4	67.9	149	....	9.6	8.2	4.4	19.9	18.2	13.1	12.2	4.0	7.4	28.2	42.6	11.0	89.3
II	120	25.8	4.3	67.1	148	12.9	9.8	7.9	4.2	20.2	18.6	12.9	11.8	3.9	7.0	31.8	41.7	12.5	92.3
III	18	23.7	4.3	66.6	143	12.5	9.8	7.6	4.2	19.5	18.1	12.5	11.6	3.0	5.7	30.3	32.2	12.2	80.0
IV	25	24.1	4.1	66.9	154	12.9	9.7	8.2	4.2	20.0	18.4	12.9	12.2	4.3	8.1	29.2	44.7	11.4	93.6
V	14	24.0	4.3	67.1	159	12.8	9.9	8.0	4.0	19.5	17.8	13.0	11.8	3.8	6.2	27.6	43.2	10.5	87.5
VI	2	......	4.0	68.0	160	11.9	10.0	6.5	3.7	19.0	17.1	11.8	11.5	2.3	8.0	28.2	20.0	11.2	67.3

TABLE 36.—Average Absolute Lineal and Areal Determinations of the Normal and Abnormal Foot when Subjected to Body Weight

Group	No. of cases	Aver. age (yrs.)	Aver. arch height (cm.)	Aver. body length (in.)	Aver. body weight (lbs.)	Linear measurements (cm.)								Areal determinations (sq. cm.)					
						Medial longitudinal	Bimetatarsal	Anterior diam.	Posterior diam.	Long axis	Short axis	Medial	Lateral	Great toe	All toes	Anterior	Middle	Posterior	Total
I(a)	58	19	4.5	68	146	....	10.18	9.13	5.59	20.80	18.92	13.43	12.29	7.80	14.39	34.12	65.74	15.72	129.01
I(b)	81	23	4.3	68	151	13.24	10.11	8.93	5.44	20.93	18.98	13.34	12.16	6.95	12.13	33.88	62.14	15.76	123.90
I	139	22	4.4	68	149	....	10.13	9.01	5.50	20.89	18.96	13.35	12.20	7.31	13.07	33.97	63.63	15.74	126.08
II	20	26	4.3	67	148	13.10	10.24	8.78	5.25	21.14	19.27	13.10	11.89	6.87	11.30	36.95	61.05	17.02	126.32
III	18	24	4.3	67	143	12.70	10.31	8.74	5.35	20.30	18.79	12.80	11.65	6.05	9.19	36.61	55.80	16.72	118.30
IV	25	24	4.1	67	154	13.26	10.16	9.11	5.65	21.18	19.30	13.36	12.30	8.03	13.20	34.53	72.48	17.24	137.46
V	14	24	4.2	67	159	13.30	10.45	9.31	5.56	20.82	18.74	13.67	11.95	8.03	13.63	34.48	70.13	16.37	134.59
VI	2	......	4.0	68	160	11.95	10.02	8.20	5.45	19.80	17.55	12.10	11.55	4.20	12.70	34.30	45.55	16.20	108.75

TABLE 37.—AVERAGE PERCENTAGE CHANGE OF THE LINEAR AND THE AREAL DETERMINATIONS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Group	No. of cases	Aver. age (yrs.)	Arch height (cm.)	Body length (in.)	Body weight (lbs.)	Linear measurements (per cent)								Areal determinations (per cent)					
						Med. long.	Bimetatarsal	Ant. diam.	Posterior diam.	Long axis	Short axis	Med. arch	Lat. arch	Great toe	All toes	Anterior	Middle	Posterior	Total
I(a)	58	19	4.47	68	146	....	4.47	8.98	18.23	4.89	3.98	1.89	0.57	47.86	51.11	20.91	30.23	27.09	29.45
I(b)	81	23	4.26	68	151	1.87	4.06	9.02	22.47	4.76	3.82	2.33	0.55	37.00	36.00	14.66	36.15	33.22	29.77
I	139	22	4.35	68	149	....	4.23	9.00	20.69	4.81	3.88	2.15	0.56	41.51	32.30	17.26	33.68	30.68	29.62
II	20	26	4.27	67	148	1.60	3.89	9.84	19.56	4.46	3.63	1.37	0.50	40.89	36.27	14.01	31.97	27.32	26.44
III	18	24	4.27	67	143	2.33	4.71	12.89	22.58	4.95	3.55	2.35	0.23	48.99	33.97	17.15	42.77	28.34	32.28
IV	25	24	4.11	67	154	2.83	4.95	10.15	24.76	5.59	4.59	3.58	0.50	40.95	37.49	15.33	38.32	34.30	32.10
V	14	24	4.25	67	159	2.91	5.31	13.60	28.93	6.22	5.29	3.96	0.91	51.47	48.83	19.90	40.21	37.78	35.65
VI	2	......	4.00	68	160	0.42	0.75	20.80	32.10	4.31	2.58	2.48	0.43	46.45	36.60	18.09	55.60	31.23	38.05

TABLE 38.—ABSOLUTE INCREMENTS OF THE AREAL DETERMINATIONS OF THE NORMAL AND ABNORMAL FOOT WHEN SUBJECTED TO BODY WEIGHT

Group	No. of cases	Average weight	Differences between areal determinations (sq. cm.)					
			Great toe	All toes	Anterior	Middle	Posterior	Total
I(a)	58	146	4.0	7.3	6.8	19.6	4.2	36.9
I(b)	81	151	2.8	4.6	5.0	22.1	5.0	36.6
I	139	149	3.3	5.7	5.8	21.0	4.7	36.8
II	20	148	3.0	4.3	5.2	19.4	4.6	33.4
III	18	143	3.0	3.5	6.3	23.6	4.6	38.3
IV	25	154	3.7	5.1	5.3	27.8	5.9	43.8
V	14	159	4.3	7.4	6.9	26.9	5.9	47.1
VI	2	160	2.0	4.7	6.2	25.6	5.0	41.0

TABLE 39.—The Force, the Distribution of Force and the Stress of the Normal and Abnormal Foot when Subjected to Body Weight

Group	Average body weight causing increment (lbs.)	Number of cases	Anterior area			Middle area			Posterior area			Calculated total area increment (sq. cm.)
			Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	Force (lbs.)	Per cent	Stress (lbs. per sq. cm.)	
I(*a*).	146	58	32.7	22.3	.96	93.5	63.8	1.42	20.2	13.8	1.29	30.6
I(*b*).	151	81	23.6	15.6	.70	103.8	68.7	1.67	23.7	15.7	1.50	32.1
I....	149	139	27.3	18.3	.80	99.6	66.7	1.56	22.3	15.0	1.42	31.5
II....	148	20	26.2	17.7	.71	98.2	66.6	1.61	23.1	15.7	1.36	29.1
III....	143	18	26.0	18.2	.71	97.9	68.6	1.75	18.9	13.2	1.13	34.5
IV....	154	25	21.0	13.7	.61	109.6	71.3	1.51	23.1	15.1	1.34	38.9
V....	159	14	27.6	17.4	.80	107.8	67.9	1.54	23.5	14.8	1.43	39.7
VI....	160	2	26.7	16.7	.78	111.3	69.6	2.44	22.0	13.7	1.36	36.8

A FIELD TEST FOR DETERMINING THE POTABILITY OF WATER; A METHOD FOR PERFORMING THE PRESUMPTIVE TEST FOR *BACTERIUM COLI* WITHOUT SPECIAL LABORATORY EQUIPMENT[1]

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(With four illustrations)

THE BACTERIOLOGICAL examination of water gives information of the greatest sanitary value. Largely through the work of the Laboratory Section of the American Public Health Association, methods for testing have been devised and formulated which constitute the standard of practice with the result that the figures obtained in different laboratories are comparable. A fundamental principle which has always guided those responsible for the "Standard Methods" of the American Public Health Association is that the technique described is merely basic, the "standard" test must conform to all the rules laid down, but additional procedures are by no means prohibited. There is no suggestion that these methods are complete for all time; in fact, it is well recognized that with advances in our knowledge there must be changes, and for this reason "Standard Methods," to serve their purpose, are revised frequently.

The complete bacteriological examination of water will always require a properly equipped laboratory and a competent bacteriologist. In proportion, however, as methods can be simplified for practical application, and as apparatus and the necessary training of the observer can be reduced, so will the applicability and practical value of the tests be increased.

One of the well-recognized difficulties in the way of utilizing the knowledge we possess is the problem of transportation. Numerous communities are deprived of the benefits to be gained from bacteriological examination of their water supply because of their remoteness from a properly equipped laboratory. While this certainly applies to many civil communities, it is especially true with regard to the Army. At present complete bacteriological water analyses are made chiefly in corps area laboratories, and the occasions are not rare when such laboratories are several days' travel from the location of a military post. The organization may be so small that a single medical officer accompanies it, and yet potable water is just as necessary for the few troops as it is for the largest city.

[1] From the Division of Laboratories, Army Medical School, Washington, D. C.

The 1923 edition of "Standard Methods of Water Analysis" states (page 98): "The time allowed for storage and transportation of a bacterial sample between the filling of the sample bottle and the beginning of the analysis should be not more than six hours for impure waters, and not more than twelve hours for relatively pure waters. During the period of storage, the temperature shall be kept as near 10° C. as possible. Any deviation from the above limits shall be so stated in making reports."

Such restrictions with regard to time are entirely reasonable, but it is obvious that under present conditions they rule out of consideration the examination of water from a post so remote that the time required for transportation is more than twelve hours. At least, they place the samples in a special class requiring special consideration and interpretation.

If, then, it might be possible to so arrange our tests that reliable information might be obtained without elaborate equipment, and especially if the results could be interpreted by persons of ordinary intelligence and without extensive laboratory training, the benefits of bacteriological water examination would be considerably extended.

It is believed that a method has been devised which will meet all these requirements in so far as the presumptive test for *Bacterium coli* is concerned.

In assembling this arrangement, specially constructed apparatus has been very carefully avoided. There have been utilized only materials always at hand about the laboratory. The arrangement is, therefore, exceedingly simple, consisting, as it does, of merely a 15-c.c. (½ ounce) homeopathic vial (20 mm. X 70 mm.) and a small tube (10 mm. X 75 mm., over all) closed at one end and inserted in the perforated cork (size 4, XXXX). The stopper is covered (just as is the standard bottle for the collection of water intended for bacteriological examination) with a muslin cap held in place by a copper wire. The bottle receives 1 c.c. of ten times concentrated standard lactose broth, and the whole is assembled and sterilized in the autoclave at 15 pounds pressure for fifteen minutes.

The formula for the standard broth is:

	Standard	*10X conc.*
Meat extract	3 gm.	3 gm.
Peptone	5 gm.	5 gm.
Lactose	5 gm.	5 gm.
Water	1000 c.c.	100 c.c.

The various parts of the "presumptive test vial" are clearly indicated in the illustration.

The method suggested for using it is as follows:

1. Each presumptive test of water made for the presence of members of the *Bacterium coli* group shall be made in five vials in order that the test may conform to "Standard Methods."

2. Each vial shall be filled in the ordinary manner as given in the Manual of the Medical Department, with only those changes (words italicized) necessitated by differences in the type of the collecting bottle. These vials are to be filled to the mark or scratch which indicates 10 c.c. (Par. 358, *Bacteriological examinations*, M.M.D. 1916, Cor. to April 15, 1917, page 115.)

Samples of water for bacteriological examination should be collected in bottles furnished for the purpose. Each bottle is sterilized before leaving the laboratory, and the *cork* stopper is protected by a piece of heavy sterilized muslin securely wired to the neck of the bottle. The stopper should not be removed until immediately before the bottle is filled.

In taking specimens from a faucet or pump (after emptying the supply pipes and connections conformably to par. 357) a small, gentle stream should be allowed to flow, the stopper taken out, the bottle grasped near the bottom, held in an upright position, and the stream permitted to flow into the bottle until it is filled to the *mark or scratch.* The stopper should then be replaced. . . . . The stopper must be handled only by the . . . . cloth-covered top. The lip of the bottle must not be brought in contact with the faucet or spout, nor should the neck of the bottle or naked part of the stopper be permitted to come in contact with any object during the manipulation . . . . The stopper should not be laid down and the cloth should not be handled by the fingers except in the act of securing the wire about it. When well water is to be examined, the bottle should be filled directly from the bucket constantly in use for drawing the water, and from no other vessel.

3. The vial being filled to the mark, the stopper with its tube is placed in the bottle tightly and the contents are agitated to mix the water and the broth. If a few drops of water overflow, this is negligible. When inserting the stopper, let the open end of the tube rest against one side of the vial and hold this side down; then, tilting the bottle, let all the air flow out of the tube so that when the bottle is turned to the upright position the tube will be completely filled with water and contain not even a small bubble of air.

4. The tube being completely filled with water, place the vial in the upright position, loosen the stopper carefully, so that if there is gas formation within the vial it will have no difficulty in escaping. With the stopper placed loosely in the bottle the muslin cap will effectively prevent outside contamination.

5. If an incubator held at 37° C. is available, the five bottles may be

placed in it and examined after twenty-four and forty-eight hours. If no incubator is available, room temperature will permit the growth of *Bacterium coli,* but vegetation will proceed more slowly at lower temperatures, the rate depending upon how near the temperature of the room approximates that of the body. With regard to the test, it is recommended by "Standard Methods" that the *Bacterium coli* "group" be considered as including all non-spore-forming bacilli which ferment lactose with gas formation and grow aerobically on standard solid media.

The formation of 10 per cent or more of gas in a standard lactose broth fermentation tube within twenty-four hours at 37° C. is *presumptive* evidence of the presence of members of the *B. coli* group, since the majority of the bacteria which give such a reaction belong to this group.

As *Bacterium coli,* if present, develops in the presumptive test vial, it will attack and decompose the lactose, the decomposition resulting in the formation of gas. The gas formed from growth within the inverted tube will collect therein and displace the broth. The amount of gas found in the tube is recorded in terms of the proportion of broth displaced. For instance, if the tube is half full of gas, 50 per cent, if one-fourth full, 25 per cent. The following is quoted from "Standard Methods":

> Examine each tube at twenty-four and forty-eight hours, and record gas-formation. The records should be such as to distinguish between:
>
> (*a*) Absence of gas formation.
>
> (*b*) Formation of gas occupying less than ten per cent (10%) of the closed arm (i.e., inverted tube). (These tubes are inserted in the cork in such a way that at least 10% projects above the upper surface of the cork, thus facilitating the readings.)
>
> (*c*) Formation of gas occupying more than ten per cent (10%) of the closed arm.
>
> More detailed records of the amount of gas formed, though desirable for purposes of study, are not necessary for carrying out the standard tests prescribed.
>
> The formation with twenty-four hours of gas occupying more than ten per cent (10%) of the closed arm of fermentation tube constitutes a *positive presumptive test.*
>
> If no gas is formed in twenty-four hours, or if the gas formed is less than ten per cent (10%), the incubation shall be continued to forty-eight hours. The presence of gas in any amount in such a tube at forty-eight hours constitutes a *doubtful test,* which in all cases requires confirmation.
>
> The absence of gas formation after forty-eight hours' incubation constitutes a *negative test.* (An arbitrary limit of forty-eight hours' observation doubtless excludes from consideration occasional members of the *B. coli* group which form gas very slowly, but for the purposes of a standard test the exclusion of these occasional slow gas forming organisms is considered immaterial.)

The "closed arm" referred to above is represented by the inverted tube of the "presumptive test vial."

Water may be considered to be potable if members of the *Bacterium coli* group are present in not more than one 10-c.c. quantity out of five, when planted in standard lactose broth and incubated at 37° C. for forty-eight hours. With an incubator available, the presumptive test may be completed within forty-eight hours, using five "presumptive test vials" and without any other laboratory equipment. If within forty-eight hours no gas appears in any of the five tubes, or if gas appears in only one of the five, the water is *potable* and no further laboratory study is necessary. If, however, gas is seen in two or more of the tubes after forty-eight hours' incubation at 37° C., the presumptive test is positive and further examination is necessary in order to determine the potability of the water.

When a 37° incubator is not available, it may be possible to improvise a satisfactory water bath, but if even this cannot be obtained the presumptive test vials may be allowed to stand at room temperature in the dark for a longer period. In any room, whose temperature is at a "habitable" point (70° F. ±), not longer than three days will ever be required. If gas appears in not more than one tube after three days in even a relatively cool room, the water may be declared *potable*. The lack of a thermometer is about the only condition which will render it impossible to improvise a water bath, however.

SUMMARY

To make the presumptive test for potability of water:

1. Take five "presumptive test vials" and add to each, by the method given above, approximately 10 c.c. of the water to be examined—i. e., up to the mark or scratch on the vials.

2. Put the stopper back tightly, shake the vial, let the open end of the tube touch the side of the vial and, turning it on its side, completely fill the inner tube with the water and broth.

3. Turn the vial upright and loosen the stopper so that any gas formed during incubation may escape.

4. When all five of the vials have been thus filled, place them in an incubator or water bath at 37° C., or in a dark place approximating as nearly as possible the temperature of the body.

5. After twenty-four hours' incubation, examine the five vials and note whether or not there has been gas formation; if there has been, record the amount in each of the five vials. There will practically always be a tiny bubble of air in the top of the tube, due to separation of a part of the dissolved oxygen from the water during incubation; if

there is not more, therefore, than a small bubble, this will be ignored.

6. The vials will be examined again after forty-eight hours' incubation, noting gas formation as at the twenty-fourth-hour examination.

7. If there is no gas formation—or less than 10 per cent—in any of the five tubes, the water is *potable* and further examination of the sample is unnecessary.

8. If there is 10 per cent of gas or more in *only one* of the five tubes, the water is *potable* and further bacteriological examination of the sample is unnecessary.

9. If there is 10 per cent or more of gas in *two or more* of the tubes, further bacteriological examination is required to learn whether or not the water is potable, and meanwhile it should be chlorinated or iodized in order that there may be no doubt as to its safety for drinking.

10. Should an incubator at 37° C. not be available and should it be impossible to improvise one, holding the tubes at living-room temperature for not more than three days will be at least equivalent to forty-eight hours in the incubator.

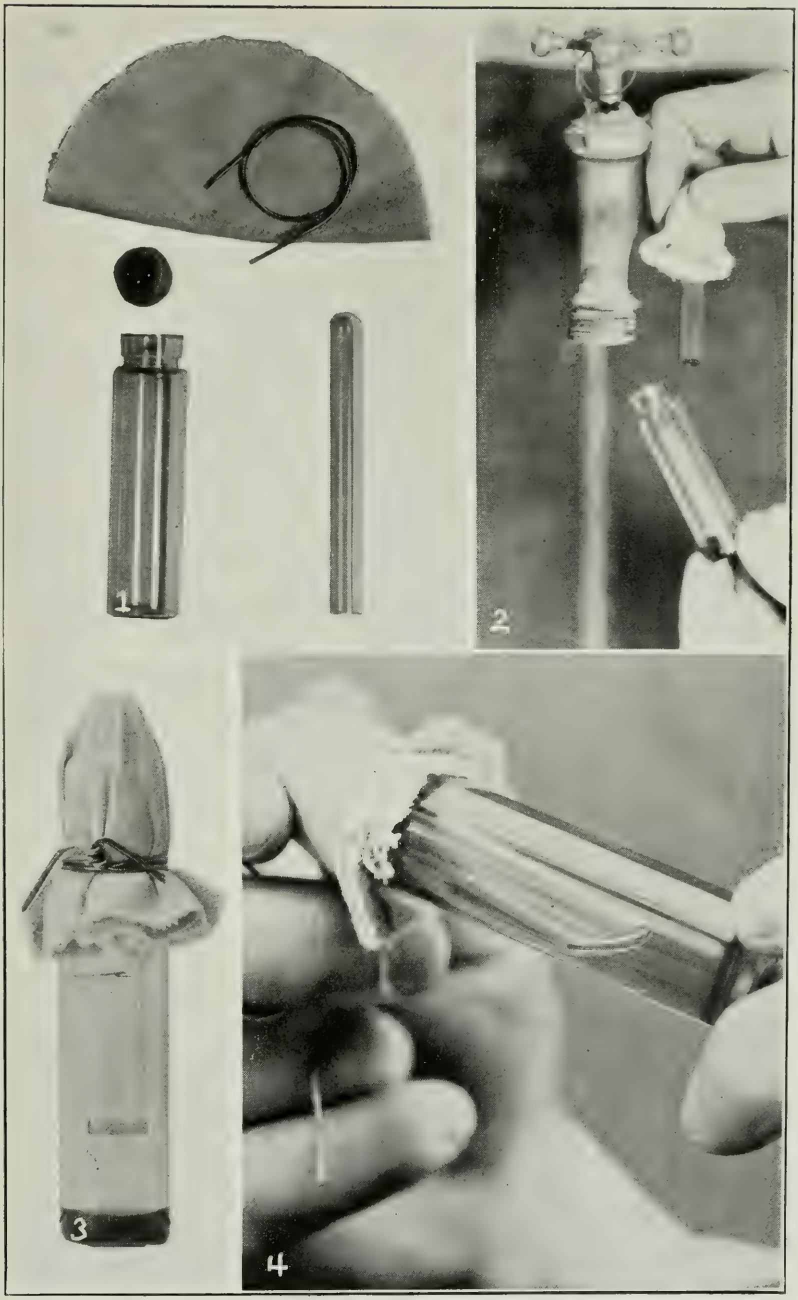

Fig. 1.—Unassembled.
Fig. 2.—The Filling.
Fig. 3.—The vial ready for use.
Fig. 4. Tilting to fill inner tube. Note that open end rests against vill.

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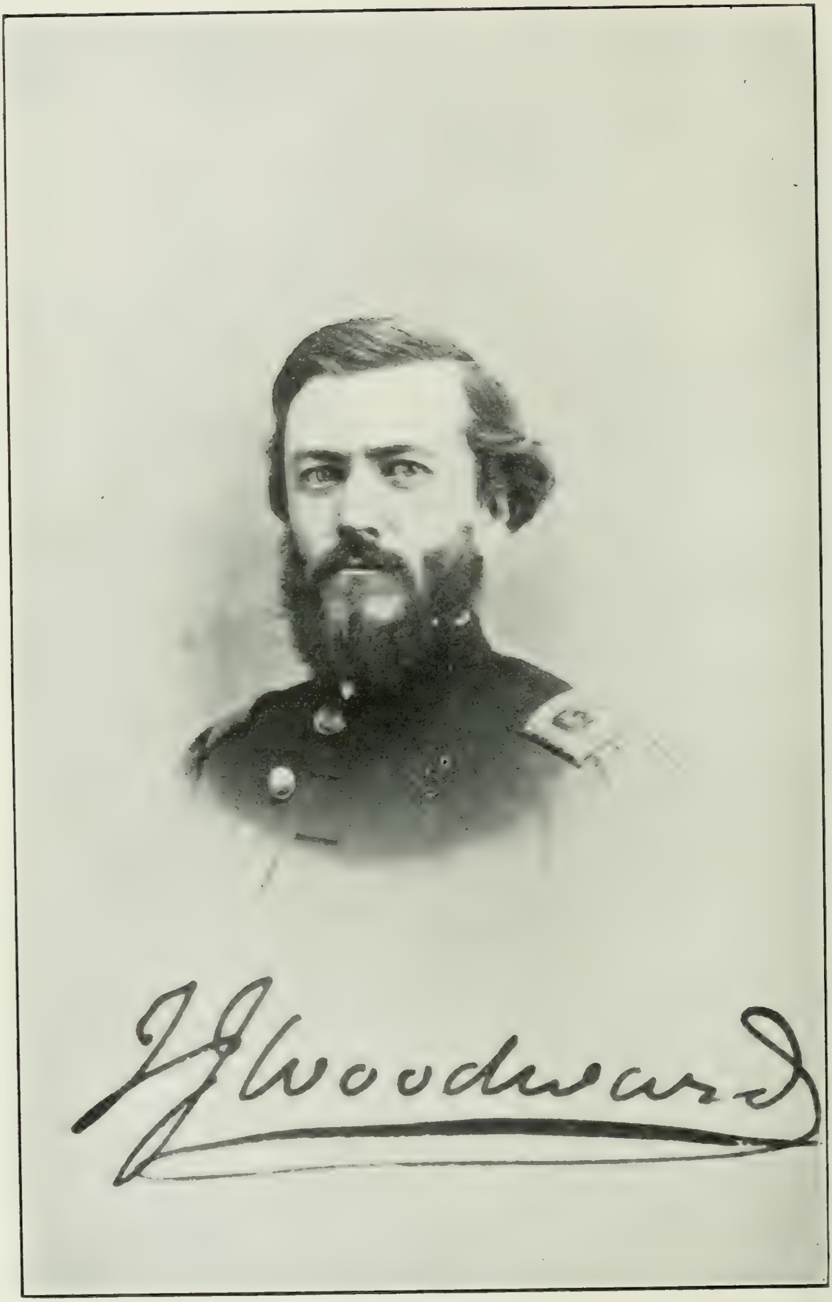
J J Woodward

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IN THE preface of the first volume of Hemmeter's "Diseases of the Intestines," the author speaks of the work of Col. J. J. Woodward in the Medical Report of the War of the Rebellion as "monumental." One of my early teachers in pathology was Prof. Wm. T. Councilman, at present Professor of Pathology at Harvard Medical School. In the year 1885, he was engaged in a study of the dysenteries which occurred epidemically at Bay View Hospital, Baltimore, and together with Dr. Lafleur he began a thorough research into the pathogenesis. Some of these intestines are depicted in my work above quoted. Some are there photographed, and others are drawn from high power magnification.

Dr. Councilman's researches led him to the Army Medical Museum at Washington, where he came across the specimens there preserved during and after the Civil War by Col. J. J. Woodward. The admiration which my teacher expressed for the penetrating thoroughness, scientific skill and artistic ability of J. J. Woodward impressed this man's work upon my mind, and on a visit to the Vienna clinic I called Nothnagel's attention to the magnificent illustrations in the "Medical History of the War of the Rebellion" which this great clinical master admired exceedingly.

This is the story of the awakening of my personal interest in the life works of a highly gifted American army surgeon, whose pioneer work and brilliant contributions to medical science it becomes my duty to bring before the profession in the perspective of recent special knowledge.

In the preface to the first volume of the "Medical and Surgical History of the War of the Rebellion," Dr. J. J. Woodward expresses due regard for the historical basis of the dominant opinions concerning the nature of the diseases to which this volume will be dedicated. He endeavors to trace all the more important facts to their sources, and in view of the many errors scattered through the textbooks of his day, some of which had been repeated for ages by authors, copying from each other, Woodward early resolved

that he would cite no authority not before him when he wrote, and that for the convenience of subsequent students he would, in every case, not only give the name of the author but the edition and page to which each citation referred. Natural as this seems in 1923, it was a very original endeavor immediately after the Civil War, and it is this painstaking regard for correctness that made Woodward's "Medical History of the War of the Rebellion" an exact piece of work for all future time.

PATHOGENESIS AND MICROBIC ORIGIN

The *Bacillus dysentericus* (Shiga-Kruse bacilli—also sometimes known as the Flexner dysenteric bacillus) and the *Amoeba histolytica,* were not known in those days.[1] The dysentery bacillus of Flexner was thought by Adolf Schmidt to be identical with the Shiga-Kruse bacillus, but according to Leschly and Sonne, one-half of the cases of dysentery in Denmark are caused by the Shiga-Kruse bacillus and the other half by the Flexner bacillus. The difference between the various bacilli that are known as etiologic factors of dysentery is the varying degree of their toxicity. In addition to these, there are three allied types of dysentery bacilli, known as the type of Strong, the type Y (of Hiss and Russell), and the Harris type. It is possible that there is a mutation of individual strains of these organisms, but it is also conceivable that certain strains of the coli group may gain new properties on the basis of an already existing infectious colitis.

The dysenteries that occur in our country in time of peace in institutions for the insane, military barracks. etc., are, in my opinion, mixed infections of the milder type (Flexner) of bacilli and not near as toxic as the conditions which Woodward describes in his works. But it has also been found that dysenteries in which either the *Amoeba histolytica* or the *Amoeba coli mitis* is found in large numbers, there may be various bacilli of the type already mentioned, present at the same time. Yes, even streptococci, typhoid bacilli and diphtheria bacilli may be present; both types of amoeba may be present in the same individual at the same time; genuine typhoid infection has been observed together with amoebic dysentery; also together with pyocyaneus infection. According to Curry, 66 per cent of the dysenteries in the Philippine Islands are caused by amoeba, and the rest are caused by the Flexner bacillus.

[1] F. Lösch published his first article on colon infections with *Amoebae coli* in Virchow's Archive, Vol. 65, 1875.

The technique of bacteriology and stool examination were an unknown territory in the days of Woodward. On page 278, "Medical and Surgical History of the War of the Rebellion," Part 2, Vol. I, he cites Ihring, who wrote an inaugural dissertation on *"Die Microscopisch-Chemische Untersuchungen Menschlichen Faeces unter Path. Verhältnissen,"* adding that he has not seen this thesis in the original but is only familiar with an abstract.

On pages 279, 280, 281, 282, he quotes articles by Bechamp, Billroth, Ferdinand Cohn, Hallier, Gros and also the famous essay by Virchow—*"Die Fortschritte der Kriegsheilkunde Besonders im Gebiete der Infectionskrankheiten,"* Berlin, 1874. There are also numerous American writers quoted in the footnotes on page 282, familiar among whom are John S. Billings, E. Curtis, W. H. Van Buren, Thos. E. Satterthwaite.

When J. J. Woodward abstracts the literature on any subject bearing on the diseases of the intestines, his words are not mere dry statements of the results of the investigations that he is studying, but he compares the results and deductions of various authors drawing parallel deductions and showing an amazing knowledge of the literature of his day and a very admirable knowledge of the French and German language. His ability as a microscopist is acknowledged by all teachers of eminence and experience in the use of the microscope, even up to the present day.

Prof. Simon Henry Gage (Microscope, 13th Ed., 1920, p. 215) writes:

> Among those who showed the possibilities of photo-micrographs was Colonel Woodward of the U. S. Army Medical Museum. The photo-micrographs made by him and exhibited at the Centennial Celebration at Philadelphia in 1876 serve still as models, and no one could do better than to study them and try to equal them in clearness and general excellence. According to the writer's observation no photo-micrographs or histologic objects have ever exceeded those made by Woodward, and most of them are vastly inferior. It is gratifying to state, however, that at the present time many original papers are partly or wholly illustrated by photo-micrographs, and no country has produced works with photomicrographic illustrations superior to those in "Wilson's Atlas of Fertilization and Karyokinesis" and "Starr's Atlas of Nerve Cells," issued by the Columbia University Press.

Professor Gage also quotes J. J. Woodward in his work on Optic-Projection stating that limelight, which is the most brilliant after sunlight and the arc light, was used by Major Woodward

in 1870, the first one to apply the oxy-calcium light for projection. A detailed list of his publications on photo-micrography will be appended.

On page 279 of "Medical and Surgical History of the War, 1861–65," he described the result of microscopical examination of the stools of his cases. He gives the objectives and the techniques and the dimensions of the microscopic organisms which he pictures, most of which could be defined as cocci and bacilli, though he also pictures torulæ-like cells (yeast cells). The spherical forms which he describes, he identifies with the micrococcus of Hallier (*Zeitschr. F. Parasitenkunde,* Bd. I, 1869) and the sphaero-bacteria of Cohn. He has observed that they are in continual active movement (Brownian movement). Woodward is aware that the organisms he finds in disease stools can also be observed in normal stools. The distinction between normal and pathogenic organism had in those days not yet been carried to exact technical methods.

On page 281 he discusses the question whether the dysenteries and diarrheas could have been caused by the bacterial forms found in the normal feces and quotes pioneer work of Hallier, in which this early bacteriologist claims that the organism which he has studied in culture experiments developed into characteristic species of microscopic organisms peculiar to each disease. This is one of the first statements expressing the specificity of pathogenic organisms. DeBarry and Hoffmann later contested this view on botanical grounds.

In reading this page 281 one cannot fail to be impressed with Woodward's critical discernment, for he discusses the arguments of Hallier, Burdon-Sanderson, and Cohn with a fairness and conservatism that is a model of scientific judgment. The main question here involved was whether one type of microorganism could transform into another type; for instance, whether a torula could become a penicillium as Burdon-Sanderson asserted, or whether micrococci could be transformed into bacilli. Woodward on page 282 leaves this question undecided.

The preface which J. J. Woodward writes in his greatest work is dated March 25, 1879, and should any coming historian on the development of clinical conceptions concerning the pathogenesis of diarrhea and dysenteries desire to find out the early American ideas on this subject, he can find them in this volume, particularly in the footnotes on pages 281 and 282.

Marcus Antonius Plenciz established the first theory of infection,

that is the origin of infectious diseases founded on the development of microorganisms, in 1762, quoted on page 207 of *"Ludwig Darmstaedters Handbuch zur Geschichte der Naturwissenschaften und der Technik."* According to Sudhoff, Varro expressed the opinion that malaria was caused by extremely small living organisms. Varro lived about thirty-five years before Christ. See also Chas. Singer, "The Doctrine of Contagium Vivum 1500–1750," Historical Section of the London International Medical Congress, 1913.

When one considers that bacteria were first seen by Leuwenhoeck in 1675 and in 1683 and that Marcus Antonius Plenciz described the etiologic significance of microorganisms for the development of infectious diseases in 1762, one must marvel at the slowness of progress in the conceptions of scientific men of the eighteenth century, concerning problems of causation of diseases which were destroying human beings at various times all over the earth by the hundreds of thousands; and yet, in spite of the possession of the microscope and the genius and vision of a few scientific prophets, it required more than one hundred and twenty-five years after Plenciz before bacteriology was taken up as a separate domain of human scientific endeavor. This reproach applies not only to the eighteenth century but also the nineteenth, for even in the days of J. J. Woodward there were teachers, professors in medical schools, who not only refused to accept the idea of the bacterial causation of diseases, but I can personally remember that they ridiculed it and, without having the slightest training or knowledge in bacteriology, they created in their students a feeling of disgust against the new science which, in many instances, acted as an incubus and deterrent to further medical study. In America, it was largely due to Surgeon General Geo. Miller Sternberg (1838-1915) and to J. J. Woodward that American medical schools were led to accept the great importance of bacteriology as an absolutely necessary science for the understanding of diseases. In 1880 Sternberg translated Antoine Magnin's French work on bacteriology and in 1892 he published his own "Manual of Bacteriology." He established the Army Medical School at Washington while he was Surgeon General, but J. J. Woodward deserves the credit for his diligent and penetrating research into the bacteriological literature of the world of his day, for the direct applications of this science to the causation and treatment of intestinal diseases.

Although Sternberg was assistant surgeon in the U. S. Army and served at the first battle of Bull Run, when he was taken

prisoner, making his escape and later again reporting for duty, and although he took part in the battle of Gaines Hill, Malvern Hill and in 1862 fell ill with typhoid fever and went through epidemics of such infectious diseases as typhoid fever, cholera and yellow fever, he is not mentioned in the list of contributors, nor of the authors cited in the "Medical History of the War of the Rebellion." This is very likely explained by the exceedingly active service which Sternberg saw during the Civil War and by the fact that he was twice very ill himself, but certainly he would have been the man most fitted to lend assistance in the bacteriology of the diarrhea and dysenteries.

To give an idea of the clinical material that the various army surgeons had to draw upon, the table on page 2, "Medical and Surgical History of the War of the Rebellion," gives a total number of cases of—

> Acute diarrhea at 1,269,027 with 4,291 deaths.
> Chronic diarrhea, 182,586 with 30,836 deaths.
> Acute dysentery, 259,071 with 5,576 deaths.
> Chronic dysentery, 28,451 with 3,855 deaths.
> Deaths from chronic dysentery 7.3 per cent and from diarrhea 16.8 per cent.

There were all together, then, 1,739,735 cases of intestinal disease with 44,558 deaths. I have read through the detail of the clinical history of cases 93 on page 103 to cases 878 on page 264 and find that there are a great many of these reports which cannot compare in thoroughness of pathologic findings with those that were reported in the same volumn as autopsies made by the Master Joseph Leidy. But apart from the thoroughness of the prosector, we have to deal with the insurmountable difficulties which the defective equipment of temporary war hospitals and the vast amount of autopsy material presented to the Medical Staff. We can, therefore, safely assume that a great many of the cases classed as diarrhea acute and chronic were, in reality, infections with either the *Amoeba coli* or the *Amoeba histolytica* or one or other of the types of the *Bacillus dysentericus* (either Shiga-Kruse of Flexner).

While it is true that Woodward speaks on page 371 of the amoeba coli of Lösch, he also speaks of the *Cercomonas intestinalis* of Lambl, and it impresses me that this is the protozoan which was later called *Lamblia intestinalis* and is now known by the name of Giardia. A protozoan organism which still is a frequent cause of severe intestinal infection in our southern states and concerning

which I described the first distinct American infection, which was reported in the Washington Medical Annals in 1902, Vol. I, March, page 64, by Chas. Wardell Stiles. That these organisms were the cause of some of the dysenteries included in Woodward's statistics there is no doubt whatever in my mind, but there were also infections with the bacillus of tuberculosis, which Woodward recognized as such, and on page 575 he devotes a chapter to this condition with a splendid photo-micographic plate of a tubercular ulcer of the ileum facing pages 582 and 584, but he also has numerous smaller illustrations of tubercular intestinal ulcers in the text. In the section on page 587, however, while it does indicate tubercules in the submucosa, the general appearance of this ulcer is that which is frequently seen with amoebic dysentery.

One can hardly resist the temptation to compare the results of J. J. Woodward's long-continued studies on the bacterial and protozoan pathogenesis of diarrhea and dysenteries with our modern knowledge of these infectious organisms and the extensive work of Kofoid and his pupils and Sydney K. Simon.

The early history of dysentery is referred to by Woodward himself in his footnotes. He even refers to Aretaios on page 362, who lived in the second century after Christ, and he refers to the efforts of the Greek physician to distinguish between ulcerations of the small intestines and of the large intestines. They attached great importance to this question, for if the large intestine were ulcerated, they hoped to reach the seat of the disease by injections from the rectum, whereas, if the small intestine were ulcerated, this could only be done by medicines given by the mouth (Galen, De Loc. Affect, Lib. VI, Cap. 2) (Ed. Kuehn, VIII, p. 383).[2]

That the word *dysenteria* (δῦς-ill, ἔνιερα-bowels) was used familiarly, in the same sense as at present, at the time of Hippocrates or even earlier, is shown by the passage in the history of Herodotus (Lib. VIII, Cap. 115), which describes a pestilence and dysentery that decimated the army of Xerxes while retreating through Thessaly.

The following definitions, from Hippocratic writings of doubtful origin, harmonize well with the descriptions and allusions scattered through the genuine books. In Regimen (De victus rat.), Lib. III (Ed. Littre, VI, p. 617), after stating that diarrhea is one of the consequences of habitually taking too much food in

[2] *Synonyms:* Dysentery (Hippocrates, Galen and other Greek writers;) (Galen—1 Com. in Prom Hip., 8, Ed. Kuhn, Tom. XVIII, B, p. 33), Tormina (Celsus); Rheumatismus intestinorum cug. ulceratione; (Caelius Aurelianus); Difficultas intestinorum.

proportion to the amount of exercise used, we are told that so long as putrescent alimentary matters only are passed from the bowels the disease is called diarrhea; "but when the body being heated, acrid matters are discharged, the intentine is excoriated, ulcerated, and the stools are bloody; this is dysentery, a grave and dangerous disease."

This Hippocratic quotation is followed by similar quotations from Celsus, Galen, Hildanus, and three-fourths of page 337 is covered with historic abstracts of such excellent arrangement and translation, that future historians will miss a great source of historic research on intestinal diseases if they neglect to study J. J. Woodward's historiographic investigations concerning acute dysentery from pages 336 to 348 of his great work.

The examinations of the stools on page 345 and the abstracts of the accompanying literature in the footnotes are highly instructive. They include special chapters on fecal matters (p. 353), on mucus and pus (p. 355), on blood and bloody serum (p. 357), on pseudo-membranes and actual cases of necrosed intestinal tissues (p. 359). This question as to whether the intestinal discharges are made up entirely of mucus formed into a pseudo-membrane containing accidental inclusions like bacteria, protozoa, blood corpuscles, pus cells, etc., or whether they are genuine pieces of the intestinal architecture itself, leads to a fascinating discussion on pages 360 to 362.

Woodward decides that among the earliest to conclude that in some cases the fragments discharged are portions of the actual intestinal coats while in others they are merely false membranes, was Morgagni, and he supported his opinion by reference to the condition of the intestinal mucous membrane after death in such cases (*Morgagni De sedibus et Causis Morborum,* Epist. XXXI, 339). In the chapter on Bacteria and Animal Forms, he attributes the first definition of infection after the inventing of the compound microscope to the ingenious Jesuit, Father Athanasius Kircher, who in 1658 asserted that microscopical animalcula were the true cause of pestilential diseases, but while this date is earlier than the reference given by me concerning Plenciz as 1762, yet in the description given by Kircher, I find that his *"vermium"* are the result and not the cause of what he calls *"Omnia Putrida."* Kircher concludes that each living substance by its putrefaction gives rise to specific animalculae.

It is evident here that Woodward in the large printed text at

the top of page 369 designates as *true* CAUSE *of pestilential disease* what the quotation from Kircher's own writing define as the RESULT *of putrefaction.* Cause and result are here evidently confused. In the discussion on page 371 Woodward comes to speak of the *Lamblia intestinalis,* now called Giardia, and the *Amoeba coli.* On this page he gives the entire early history of the clinical recognition of amoebae as pathogenetic factors.

On page 377 he describes fat stools, and therewith is connected a historic study of the occurrence of fat in the stools which goes back to Hippocrates. On page 382 he has a reference to the formation of pseudo-gall stones caused by olive oil, and on page 383 he emphasizes that fatty concretions of various sizes and consistence can be found in the stools of patients who are suffering from dysentery or typhoid fever, when they are kept on a milk diet.

The so-called lymphoid swarms pictured on page 486 magnified only 300 diameters remind one very strongly of the appearance of amoeba when hardened in Miller's or Zenker's fluid. The same can be said of the figure on page 469.

On page 825 there is the only history of methods for injecting fluids, etc., into the rectum and colon which I have found in the English language. Woodward quotes Herodotus (Euterpe, Cap. 77) that the Egyptians purged themselves every month, three days successively, seeking to preserve their health by emetics and clysters. An enema apparatus by Gatinaria from the year 1525 is pictured on page 825. The various types of solutions for enemas are given. Even iodine and nitrate of soda are described as enema ingredients, and also the therapeutic attempts of E. Hare ("Treatment of Tropical Dysenteries"; the Edinburgh Medical and Surgical Journal, vol. 72, 1849). Hare used a long flexible rubber tube passed beyond the sigmoid flexure and a force pump, but Dulles found that simple gravity was safer than the force pump of Hare.

This review of the principal chapters of Woodward's "Monumental Medical History of the War of the Rebellion" necessarily had to be simply an outline, for such a massive volumn of 869 pages, not including twelve pages of introduction, could not be abstracted in any other way.

Victor C. Vaughn, in his admirable work on "Epidemiology and Public Health," speaks of J. J. Woodward as follows:

> The nature, prevalence, causes, and the varieties of the alvine fluxes prevalent among the soldiers during our Civil War were recorded and described in a most masterly way by Woodward.

He (Woodward) was halfway convinced that the virus of these diseases is present in the stools of the sick, and in one or two places he almost hits upon the true cause of the wide prevalence of diarrhea and dysentery in the camps. Although Woodward seldom speaks with positiveness, there are to be found in his voluminous reports some suggestions, the value of which has been more recently demonstrated. For instance, no less an authority than Virchow had taught that dysentery may be due to constipation and the consequent ammoniacal fermentation of the fecal matter in the intestine. Woodward disposes of this error by showing statistically that dysentery in the great majority of cases is not preceded by constipation.

Prof. Vaughan wrote to the author May 8, 1922:

Dear Dr. Hemmeter:

I do not think that you can say anything too eulogistic of Woodward. He certainly was far ahead of his time and the "Medical and Surgical History of the War of the Rebellion" is a monument to his learning and industry.

The following personal notes and a list of his publications were taken from the *Philadelphia Medical News,* August 30, 1884, which also contains an Obituary of Surgeon Joseph Janvier Woodward, U. S. A.:

BREVET LIEUTENANT-COLONEL JOSEPH JANVIER WOODWARD

Surgeon, U. S. Army, who died near Philadelphia, on Sunday, August 17, 1884, at 1 p. m., was born in Philadelphia, October 30, 1833, and at the time of his death was not quite fifty-one years of age. He was educated at the Central High School of that city, and in 1850 received the degree of A.B. He devoted himself to the study of medicine and graduated from the University of Pennsylvania in 1853. Two years later, in 1855, he received the degree of A.M. from the Central High School, acting as the valedictorian of his class. Immediately after his graduation, he entered energetically upon the practice of his profession in his native city, devoting a large portion of his time to that branch in which he afterwards achieved such a decided success—the microscopical investigation of pathological anatomy, and of kindred subjects. On May 17, 1858, he read before the Biological Department of the Academy of Natural Sciences, in Philadelphia, a paper, "On the Minute Anatomy of Three Cases of Cysto-carcinoma," which will be found on page 54 of *The American Journal of the Medical Sciences* for July, 1858. Other papers, read before the same society, followed rapidly: "Remarks on Anatomical Diagnosis of Cancer," November 15, 1858; "On Suppuration in Cancerous Growths," March 21, 1859; "On Errors in the Anatomical Diagnosis of Cancer," December 4, 1859; and "On a Secondary Cancer of the Axilla," January 16, 1860.

When the war broke out in 1861, he offered his services to his country, and entered the Army as Assistant Surgeon, U. S. A., on August 5, 1861. He was with the Second Artillery, in the Army of the Potomac, until May 19, 1862, when he was assigned to duty in the office of the Surgeon General in Washington, where he located and organized several hospitals, and, for a brief period, was in charge of the Patent Office Hospital. Relieved from this duty, he was placed in charge of the Pension Division of the Surgeon General's Office and of the Medical Section of the Army Medical Museum, which had then been opened for the collection of specimens of morbid anatomy, surgical or medical. At the same time, the task was assigned to him of collecting the material for the *medical* portion of the "Medical and Surgical History of the War," while his colleague, Dr. Otis, had charge of the collection of material for the *surgical* history and the surgical branches of the museum collection. Both these officers prepared reports on the material available, which were published as "Circular No. 6" of the Surgeon General's Office, on November 1, 1865. The second half of the circular, which was very favorably received by military surgeons, was prepared by Dr. Woodward. In the following year he made a report, "On Epidemic Cholera in the Army of the United States during the year 1866," which appeared as "Circular No. 5," Surgeon General's Office, on May 4, 1867, and which was followed in June, 1868, by "Circular No. 1," "Report on Epidemic Cholera and Yellow Fever in the Army of the United States during the year 1867."

In the meantime, the collection of the material for the Medical History of the War had progressed rapidly, and, on November 12, 1870, he issued his first volume of 726 pages, quarto, containing a series of statistical tables, presenting a summary view of the facts embodied in the monthly reports made to the Surgeon General with regard to the sickness of the Army, the deaths and the discharges on surgeon's certificate of disability.

After the close of the war, he had returned with increased fervor to his investigations in microscopy, and especially in photomicrography, and the results of his experiments, which made him famous in Europe as well as at home, were given in a series of publications which followed each other in rapid succession:

Report on the Magnesium and Electric Lights as applied to Photo-micography, 6 pp., 4to, 11 photographs. Surgeon General's Office, 1870.

Report on the Oxy-calcium Light as applied to Photo-micography. 3 pp., 4to, 2 photographs. Surgeon General's Office, 1870.

Report on an Improved Method of Photographing Histological Preparations by Sunlight. 10 pp., 4to, 11 photographs. Surgeon General's Office, 1870.

Report on the Histology of Minute Blood-vessels. 8 pp., 4to, 11 photographs. Surgeon General's Office, 1871.

Report on the Minute Anatomy of Two Cases of Cancer. 10 pp., 4to, 2 photo-lithographs. Surgeon General's Office, 1872.

Memorandum on Pleurosigma Angulatum and Pleurosigma Formosum. 4 pp., 4to, 8 photographs. Surgeon General's Office, 1871.

Memorandum on Surirella Gemma. 1 p., 4to, 2 photographs. Surgeon General's Office, 1871.

Memorandum on the Test Podura. 3 pp., 4to, 5 photographs. Surgeon General's Office, 1871.

Memorandum on Amphipleura Pellucida. 1 p., 4to, 2 photographs. Surgeon General's Office, 1871.

Memorandum on the Nineteen-band Test-plate of Nobert. 4 pp., 4to, 9 photographs. Surgeon General's Office, 1872.

Four Letters to the Surgeon General, accompanying Photographs of the Mosquito, certain Parasites, the Proboscides of certain Flies, and Miscellaneous Photographs of Insects and Parts of Insects. 8 pp., 4to, 35 photographs. Surgeon General's Office, 1872.

Remarks on Photographic Micrometry in Trans. of the American Medical Association, 1876; Application of Photography to Micrometry, with Special Reference to the Micrometry of Blood in Criminal Cases. *Ibid.*

In 1876 he had charge of the representation of the Medical Department of the United States Army at the International Exhibition at Philadelphia, and the success of the medical exhibition was mainly due to his energy and activity. During the succeeding two years he devoted himself entirely to the preparation of the second *medical* volume, which appeared on March 25, 1879. The work treats on the "Alvine Fluxes" and will be a lasting testimony of the zeal and indomitable perseverance of the author. In careful and painstaking research of the literature of the subject, it surpasses all previous publications. The anxious pursuit of this work had gradually undermined his constitution, never very robust, and in the summer of 1880, he went to Europe to regain his health. He returned in a somewhat improved condition, but unfortunately was again prostrated by a fall from his horse in the spring of 1881, by which he fractured his leg. Barely recovered from this accident, he was called, in July, 1881, to the bedside of the lamented President Garfield. His quiet and patient services were frequently under a flood of abuse from professional as well as non-professional journals. We will only here state that he kept full notes of daily, even hourly observations of the patient's condition, which he intended to publish as a defense, if such were needed, at some future time. Sickness and death have despoiled him of this opportunity.

Time and space have allowed us to refer only to a few of the numerous publications of this indefatigable worker. A close observer, tenacious in his convictions of what he conceived to be right, writing to the point without flourish or embellishment, fearless in the expression of his views, courting rather than avoiding criticism, he was ever ready to enter the lists in defense of his opinion.

Dr. Woodward's last editorial work was his obituary notice of his colleague Otis, which appeared in the *American Journal of the Medical Sciences,* July, 1881.

"For faithful and meritorious services during the War," Dr. Woodward received the brevet ranks of Captain, Major, and Lieutenant Colonel, and on June 26, 1876, was promoted to the rank of Major and Surgeon. He became a member of the American Medical Association in 1865, and in 1881 was chosen its president, being the first medical officer from the Army to whom this honor was accorded. He was a member of the College of Physicians of Philadelphia, of the National Academy of Sciences, of the Philosophical Society of Washington, and honorary member of the Royal Microscopical Society and of the Quekett Club of London, of the Liverpool and Belgian Societies of Microscopy, and of many other societies in this country as well as in Europe.

His decease added another name to the list of prominent men connected with the Surgeon General's Office, whom death removed within the brief period of three and a half years. On February 23, 1881, occurred the death of G. A. Otis, the famous author of the history of the surgery of the war. Two years later, on April 5, 1883, Brig. Gen. J. K. Barnes, who had watched by the bedsides of two martyred Presidents, passed away, and, on October 10, of the same year, Surgeon General C. H. Crane, at whose suggestion both Woodward and Otis had been selected as the compilers of the Medical and Surgical History, died after a brief illness.

WHAT IS A MEAN ANNUAL DEATH RATE?

By Major PAUL R. HAWLEY
Medical Corps, United States Army

(With one chart)

IN THE February number of the Military Surgeon Major Milton W. Hall offered a suggestion for the calculation of a mean annual rate of morbidity or mortality which he believed to possess certain advantages over the rate which is used by the Surgeon General's Office. His paper was vigorously attacked in the following issue by Major Albert G. Love. I have no desire to enter into any controversy. There is, in fact, no possibility for a controversy over the point which has been raised. The purposes of this paper are to point out the cause of the disagreement, and to discuss, in a very brief and inadequate fashion, the meaning of averages.

A rate is an index number. It is essentially an abstract number, a ratio, and denotes neither frequency nor magnitude of attributes. It is derived by a combination of a number of variables and constants. If the arithmetic of such a combination be correct, the index number is unquestionably proper, *per se*. For example, suppose an index number be formed to express the ratio between total deaths from pneumonia in a command and the mean number of corporals in that command. We have

$$R = \frac{D}{C}$$

where R is the index number, or rate; D is the total number of deaths from pneumonia; and C is the mean strength of corporals. If it be desirable to express the ratio in terms of deaths per some round number of corporals—per hundred, or per thousand—it is necessary to introduce this round number into the equation in the form of a constant (K); whence, we have

$$R = \frac{KD}{C}$$

Our index number is quite proper in itself. Obviously, it cannot mean very much; and therein it is not unique as index numbers go. It is when we attempt to use it for a purpose for which it is unsuited that we get into difficulties.

That, it appears to me, is the essence of the controversy. Each writer has attacked the index number of the other largely on *mathematical* grounds when, as a matter of fact, both their index numbers are, in themselves, quite proper. The mathematics of each is unimpeachable. There is no fallacy in the calculation of the rate used by the Surgeon General's Office; neither is there any fault with the method proposed by Major Hall. It is the use, rather than the derivation, of a rate that is open to attack.

For example, Major Hall has shown that no proper conclusions concerning the relative forces of mortality in different commands may be based upon a comparison of their death rates when these rates have been calculated by the present method—and especially when the commands have varied independently in monthly strength. But that by no means indicates a fallacy in the calculation of the rate. It might be pointed out that Major Hall could not, with his index number, arrive at the total deaths in a command, given its mean annual strength. But, with the annual death rate now used, the solution is one of simple arithmetic.

The index number must fit the purpose for which it is designed. If Major Hall's method gives him an index number which suits his purpose better than the other rate, he is unquestionably justified in his preference. But when he proposes that it is the *correct* rate to use in comparisons of forces of mortality, he is in error. It may safely be said that, for general use, one rate is almost as objectionable as the other. Both are, at best, the roughest kind of approximations.

The sound advice which Major Love gives concerning the fallacies of all crude rates indicates his familiarity with statistical pitfalls. And I am quite certain that he did not intend to generalize in his statement about the averaging of ratios. Means of ratios may be computed with or without reference to the original material. We have only to cite the corrected death rates computed by the Registrar General of England and Wales. A corrected death rate is a weighted average, but it is not weighted with the original material. Once the age specific rates are derived, the original material is abandoned, and these rates are weighted with a standard population. A corrected death rate is a mean, and we shall see that the rate Major Hall proposes is quite analagous to a corrected death rate—it is a death rate corrected for strength—although he arrives at it from a different point of approach.

In support of his contention that ratios must be averaged with

reference to the bases from which they were computed, Major Love gives the following example:

I		II	
$1,000 at 6 per cent for 1 year —	$ 60	$3,000 at 6 per cent for 1 year —	$180
2,000 at 7 per cent for 1 year —	140	2,000 at 7 per cent for 1 year —	140
3,000 at 8 per cent for 1 year —	240	1,000 at 8 per cent for 1 year —	80
$6,000	$440	$6,000	$400

Let us approach this problem from a different point of view. Assume that these represent the operations of two banks, I and II. These two banks have agreed to advance their rates simultaneously, charging 6 per cent the first year, 7 per cent the second year, and 8 per cent the third year. Assume that we know nothing of the amount of principal loaned by either bank during the three years. Disregarding the principal entirely, it is obvious that *one* mean annual rate of interest is 7 per cent, since the time interval during which each variable rate is charged is the same.

By dividing 440 and 400, in turn, by 6,000, Major Love derives index numbers 7 1/3 per cent and 6 2/3 per cent, respectively. Strictly speaking, each index number that he derives is the ratio of the *total interest collected* to a *total principal* loaned at *three variable rates of interest.* Whether or not this be a mean annual rate of interest depends upon the definition of that term. It occurs to me that a rate of interest is an entity, agreed upon in advance of the loan, and not dependent upon the *amount* of money which actually accrues from the principal loaned. It is suggested that a preferable term for Major Love's index number is the mean rate of earnings rather than of interest. However, this savors of quibbling over minute distinctions in words rather than in meaning, and we are quite willing to concede his definition. The point is that he has unquestionably arrived at a true mean of something. His mean is weighted for principal and for time; the arithmetic mean of the rates is weighted only for time. But they are both true averages.

Averages, or means, are of several kinds. Consequently, whenever a mean is used, it should be carefully defined. In the absence of definition, an arithmetic mean is usually implied. For example, we have the three values, a, b and c, of a particular variable. True means of these values may be derived in a number of ways. Without entering into a discussion of their application, a few formulae are given, each of which will give a true, although a different, mean.

The Arithmetic Mean: $M = \dfrac{a + b + c}{3}$

The Geometric Mean: $\log M = \dfrac{\log a + \log b + \log c}{3}$

The Harmonic Mean: $\dfrac{1}{M} = \dfrac{1}{3}\left(\dfrac{1}{a} + \dfrac{1}{b} + \dfrac{1}{c}\right)$

The Root Mean Square: $\sigma = \sqrt{\dfrac{a^2 + b^2 + c^2}{3}}$

These examples are given, not with the idea that they are all applicable to the present problem, but to illustrate the fact that a true average may be derived in any one of a number of ways. It follows that a strict definition of any average is essential to its correct use and intelligent discussion. The death rate calculated in the Surgeon General's Office is a crude rate, as Major Love pointed out. It is the ratio of one thousand times the total deaths to the mean strength. The rate proposed by Major Hall is a *mean monthly rate per annum*—which is, strictly speaking, quite different from a mean annual rate.

To demonstrate the soundness of the index number proposed by Major Hall, we may inquire into the exact meaning of an annual death rate per thousand per month. An annual death rate per thousand of 12.07 for January, 6.96 for February, 8.22 for March, etc., means that, had the same rate of mortality continued throughout the year as prevailed in January, 12.07 out of every thousand living would have died at some time *during the year;* and similarly for the other months. Let us reduce this to its ultimate significance in the case of Private John Doe. This means, in his case, that had the same rate of mortality continued throughout the year, the probability that Private Doe would die during the year would have been .01207,[1] or .012. But the same rate of mortality did not continue. In February the probability that Doe would not survive the year dropped to .007. In March it rose to .008. In other words, the probability of Private Doe dying within the year was constantly changing—as Farr has said, changing insensibly every moment. But, for convenience in measuring it, we select some arbitrary interval of time, and assume that it has remained at its average level throughout that interval. In the army this interval is one

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[1] It has not been forgotten that $q_x = \dfrac{m_x}{1+\frac{1}{2}m_x}$ but the introduction of this correction would have confused the argument. On the other hand, the logic has not been invalidated by the omission.

month. So, according to our arbitrary method of calculating rates, the probability that Private Doe would die during the year changed twelve times in that same space of time. How may we calculate a mean probability for the space of the year? Obviously, Private Doe is either present or absent *in toto*. He is not one-third present in January, one-half in February, two-thirds in August, etc. Accordingly, in the calculation of a mean probability, Private Doe's strength is unity; and a proper mean may be obtained by averaging the twelve variable probabilities.

This is, in effect, what Major Hall has done. He has corrected for monthly variations in strength by regarding each month as a unit, and its strength unity. He would have arrived at exactly the same result had he taken the various monthly rates per annum, applied each to a standard monthly strength, and from the hypothetical number of deaths so obtained calculated a crude annual rate for the standard population. He has illustrated this in his paper from a slightly different angle. It is in this way that his rate is analogous to the corrected death rate used by vital statisticians everywhere. Instead of correcting for age in a population which varies insignificantly in strength, as is the purpose of the ordinary corrected rate, he has corrected for variations in strength between two populations which differ insignificantly in age distribution. His index number may be used for comparisons between different commands *within the limitations of that index number,* remembering at all times that it is, at best, a makeshift, and not to be used when more specific rates can be had.

His index number will give an erroneous impression in instances where there has been during the year wide fluctuations in rates. Fig. 1 illustrates this point which, however, scarcely requires illustration. Camp B has a mortality rate consistently lower than that of Camp A, except for the brief period of the epidemic. Obviously, in general, the force of mortality is lower in Camp B. Yet the mean monthly rate per annum is higher in Camp B. Major Love emphasized this point, and little need be added here. No annual rate, or mean monthly rate, can give even an approximate picture of the mortality experience of the year 1918 (except, of course, the simple total mortality). And, in so far as Major Hall proposes his index number for just such experiences, he is in error.

Major Love's examples of the calculation of the mean height of men were classical examples of frequency distributions of attributes, and not of ratios.

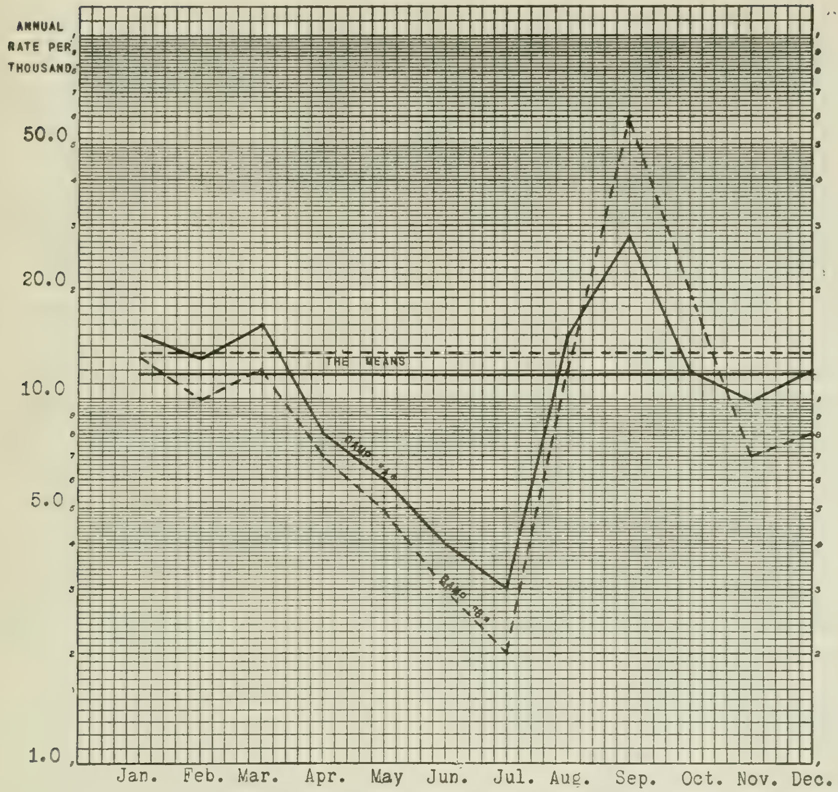

FIG. 1.—Showing the unreliability of a mean monthly rate per annum in cases where there has been a wide fluctuation in the monthly rates.

In the publication of any statistics, the data should be reduced to as near the ultimate frequencies as space and money will permit. Then all of us may form our own index numbers to serve specific purposes. We have, locked away in the army files, the greatest volume of accurate morbidity statistics in the United States. No one knows what a more extensive analysis of these data might reveal. If data are worth the collecting, are they not worth the publishing?

REFERENCE:

YULE, G. U.: An Introduction to the Theory of Statistics, London, 1919, Chas. Griffin & Co.

EDITORIAL

LORD KITCHENER AND MEDICAL ADMINISTRATION ON THE WESTERN FRONT

Lord Esher's book, "The Tragedy of Lord Kitchener" (New York, 1921), should be read by all army people who are interested in the reasonable proposition that success in military affairs and operations depends largely upon getting the right fitting man into the right place at the right time. The tragedy of Kitchener's career as Secretary of State for War lies in the simple fact that he was a square, solid stick forced into a round hole by the fatalistic circumstances attaching to his high worldly place and his great reputation as a forceful commander. In this book, the main plies in his character, now fairly well known, are sketched out along broad lines. Of an old English family, filtered through Ulster, his tall, handsome, manly and martial outside was of the North Irish type, but in his mental processes there was nothing of the aggressive cocksureness of the Ulsterman. His mental heritage was rather of the slow-going, Anglo-Saxon order. His reputation was early established by General Gordon as "one of the very few superior British officers with a cool and good head, and a hard constitution." Up to the European War, practically all his military career had been spent in the tropics and the desert—Arabia, North Africa, India—and through this experience he early acquired the aloofness, taciturnity, apparent inscrutability, tortuous mental processes and confusional loquacity under excitement[1] that characterize the Oriental. He lamented that it had never been given him to spend a single winter in England. The "unconscious restraint" of the desert solitude became part of his being. "The slow processes of the Orient were burned into him by the Egyptian sun." Hence, "when he thought of war, it was after the manner of Darius—slow-moving hordes concentrating slowly upon their objective with fatal method," never "the lightning stroke of Napoleon," never the *aller droit au but* of the Occidental. Add to this that the curious desert isolation, which made his tall figure seem like "a Kadi under a palm tree" in a London drawing room, turned him into a natural autocrat of Oriental pattern, never addressing or noticing a private soldier, "a hater of channels, who never issued written orders, not even for such operations as those in the Sudan," indifferent to womankind, caring (like the Oriental) more for things

[1]Of this phase, Lord Esher says: "His form of speech was Cromwellian in its obscurity and incoherence. He would seem to be thinking aloud, his mind tossing in a flood of difficulties. The dialecticians and lawyers who sat around him could make nothing of it or him."

and *objets d'art* than for people, and you have the man. Conceive, then, a mind, hampered and inhibited by such restrictions, with humor only of the grimmest kind, suddenly pitchforked, at the age of mental tire, into the horse's-neck-tying atmosphere of Whitehall and Downing Street.

On assuming the office of Secretary of State, Kitchener immediately grasped, like a good soldier, the fundamental proposition: "I am here to conduct a great war, and I have no army." He then proceeded to raise the huge volunteer organization which proved to be his main war achievement. But, latterly confused, embarrassed and paralyzed by his official surroundings, he balked and failed utterly on the crying questions of adequate munitions and universal conscription, opposing these great problems with the "passive resistance to change" that is so exquisitely Oriental, along with superadded traits of feigned stupidity or the incoherent chafering of the Eastern bazaar, where time is not (as with Occidentals) the equivalent of money. The council of 23 was described by a ribald spirit as "a vestry meeting with the Vicar in the chair." The net of convention and the dialectics of representative government, where "all the talking was done by the people least competent to discuss the subject," was too much for the single-hearted soldier, "admirably equipped with a few simple precepts, not untinged by methods which the Israelites inherited from Jacob, and the statesmen of the Renaissance from Machiavelli." The press and the politicians turned against him, he was presently shorn of his powers as to munitions, recruiting and operations, and the sinking of the *Hampshire* in the Orkneys ended the tragedy of his life. With his slow, stolid, mental approaches, he never grasped, as French and Robertson did, the necessity of extra munitions in the static warfare of the trenches or the importance of universal conscription; while on the Western Front, the great question of decentralized or dissociated military administration prevented the Allies from making any concerted advance until Foch assumed the supreme command.[2] Of Kitchener's failure to be receptive to the new ideas engendered by novel situations, his tendency to antagonize a proposition whether he agreed with it or understood it at all, Lord Esher has a telling paragraph:

> How unfruitful is the study of previous campaigns unaccompanied by vision of scientific developments is illustrated by Sir John's reflections, when we recall that some years before this date a civilian who had closely studied modern war, a Swiss publicist, prophesied in elaborate detail the trench warfare of the Western Front, its static conditions, and explained the reasons for the conclusions he had formed. Although this man's book

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[2] As to the absolute necessity of centralized administration in major military operations, Napoleon's maxims are conclusive: "Success with ways and means depends upon unity of action"; "Either Kellerman or I, but not both in conjunction," etc.

received much attention at the time of its issue, and his theories were given wide publicity, military opinion, except that of Lord Roberts, was hermetically closed against his arguments. But Lord Roberts, in spite of his seventy years, had preserved a mind which, though eager in convictions, was singularly open to novel ideas and new impressions. The average English soldier before and after 1640 has invariably shown himself indifferent to military conceptions unless based on past military experience. In view of the next great war, all military training is no doubt strictly conforming to the experience gained in the last, and one may be sure that young soldiers are being taught, at Aldershot and elsewhere, manœuvres and tactics based upon 1916–18, while their Staff Officers are stereotyping deductions drawn from the same experiences; and yet science, sleepless, restless, and evolutionary, is exploring every day new methods of destruction, and opening up avenues to novel tactics, rendering certain that war in the future will be waged with weapons hitherto undreamed of, fought, in the air and under the water, by contrivances which will render those of 1918 as obsolete as gunpowder rendered bows and bills.

Yet on two occasions, Kitchener rose to the situation and approved himself the capable commander, and K. of K. of old. The first was at the Calais Conference of 1915, where "freshened up by contact with the French, whose language, of all the English present, he spoke tersely and well," he surprised his foreign colleagues (hitherto convinced that he was stupid and mediocre) by his candor, forceful resolution, fairness and ready insight into the political motives affecting military plans. The other "meteoric moment" was his swift, vigorous action in aid of improved medical administration at the front, incidentally a matter reflecting great credit upon American volunteer organizations before our entry into the war:

The experiences of previous wars, notably in South Africa, had stereotyped the Field Service Regulations for the Royal Army Medical Corps. Its legacy was a set of iron rules which Medical Officers in the Field were powerless to amend either by appeals to the Adjutant General at Head-Quarters, who was their official Chief, or by private representation to the War Office, where no one could be got to visualize the scenes then being enacted in France.

From the casualty stations to churches and barns, where they lay for days, and thence to railhead at Chateau-Thierry, the wounded were borne in jolting Army Service Corps waggons. The transit took in the ordinary way about twelve hours. Often men were left for a day and a half lying on straw, with their field-dressings unchanged, or they lay on stretchers in the broiling sun on railway-platforms with a few tired orderlies to look after them until they could be lifted off and piled into horse-boxes and cattle-trucks. It took from three to five days before a sufferer could possibly reach a Base hospital. In those days there was not one motor ambulance in the advanced zone of the British Army, and only one available for the British military hospital at Versailles. Although the British Red Cross Society had offered to send two hundred motor ambulances for service at the Front, the offer had been refused. Not a nurse was allowed on the railway-platforms at any station during the long halting journey from Chateau-Thierry to the Base. Although the British Red Cross Society had offered to send a thousand trained nurses to France, many of whom could have been stationed on our lines of communication, the offer had been refused.

There was one bright spot in this tragedy of pain. To Villeneuve St.-Georges there

came to meet every train of wounded ten motor ambulances from the American hospital at Neuilly. The American surgeon in charge selected the most dangerous cases, and in less than an hour they were in bed in one of the most admirably equipped hospitals in France. The British Red Cross offered to open any hospitals required in Paris, and Dr. Garrett Anderson and her staff of women, Rachel Lady Dudley with her fully equipped Australian hospital, the Duchess of Westminster and others, were waiting in France, forbidden to unpack. No Red Cross aid was required beyond Rouen. That was a decision from which there was apparently no appeal. When these facts were reported to Lord Kitchener, when he was told that every statement could be corroborated by Sir Alfred Keogh, at that time Commissioner of the B. R. C., who was kicking his heels in Paris, as well as by Lord Robert Cecil, who rendered invaluable assistance and advice, he was deeply angry. Some who were present at the War Office on that occasion for the first time saw the old K. of K. in action. Within a few moments of becoming acquainted of all these facts he rang his bell and summoned the acting Head of the R. A. M. C. (the Director-General, Sir Arthur Sloggett, who afterwards filled with great distinction that office in the field, being seriously ill), and in short, sharp sentences, without question or comment, issued verbal instructions ordering the Red Cross hospitals to be freed, and granting every request which the British Red Cross had made. Within a few hours Sir Alfred Keogh had been recalled from France, and appointed Director-General of Medical Services at the War Office, and from that moment dates the efficiency to which the Royal Army Medical Corps attained, thanks to the liberal policy of its chiefs in London and at G. H. Q. With Sir Arthur Stanley and the British Red Cross Sir Alfred Keogh worked hand in hand, and he never refused help when offered by organizations or individuals unless reason for doing so could be given which, if necessary, could have been justified in public.

What would have taken any other Secretary of State ever known or imagined, days of reflection over files of Memoranda, possibly followed by the appointment of committees of investigation, was done in a flash by the ringing of a bell and a word of command. He was on that day the Kitchener of Khartoum, whom his political colleagues never saw, but who for the first year of the war stood between them and disaster.

Underneath Kitchener's stern exterior were irresponsible traits of gentleness and tenderness toward friends and comrades that cropped out occasionally, and of which the wounded animal phase, when fate left him friendless, was a part. What he did accomplish within the thorny quickset of official red tape suggests what he might have been capable of in his own proper field before the period when the grasshopper is a burden and "*les vieux militaires finissent par radoter.*"

Colonel Repington[3] has a very just estimate of Kitchener:

> The services which he rendered in the early days of the War cannot be forgotten. They transcend those of all the lesser men who were his colleagues, some few of whom envied his popularity. His old manner of working alone did not consort with the needs of this huge syndicalism, modern war. The thing was too big. He made many mistakes. He was not a good Cabinet man. His methods did not suit a democracy. But there he was, towering above the others in character as in inches, by far the most popular man in the country to the end, and a firm rock which stood out amidst the raging tempest.

F. H. Garrison.

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[3] Repington: "The First World War." Boston and New York, 1921, I, 212.

IN REGARD TO OUR LEADING ARTICLE

Attention is invited to the leading article in this issue which we commend to our readers as a particularly thoughtful and thorough piece of writing on this very important subject.

This article should have particular interest to the R. O. T. C., since it is the product of one of their own members who is the first to have finished the course of instruction in Minnesota and be commissioned. The high character of his writing bears testimony to his good standing throughout the course of the R. O. T. C. in Minnesota.

JAMES ROBB CHURCH.

BOOK REVIEWS

Tuberculosis and the Community, by John B. Hawes, 2d, M.D., Director, Clinic for Pulmonary Diseases, and Assistant Visiting Physician, Massachusetts General Hospital; Instructor, Graduate School of Medicine, Harvard University; Consultant in Diseases of the Lungs, New England District, U. S. Veterans' Bureau; President, Boston Tuberculosis Association; Member, National Tuberculosis Association, Massachusetts Tuberculosis League, Etc. 8°, 168 pp. Philadelphia and New York: Lea & Febiger, 1922. Price, $1.75.

This little book is intended for the use of the student interested in the hygiene of the community suffering from tuberculosis rather than the individual. As such it fills a gap in the literature. The author first discusses the history of tuberculosis, showing that it has been known since the most remote times. Its frequency is clearly demonstrated by a few well-chosen comparisons. Tuberculosis kills more people yearly than fell in the whole period of the Civil War, and its death toll is greater than that of all infectious diseases of childhood combined. One out of every nine persons dies of it, and someone succumbs to it every minute of the twenty-four hours. Tuberculous infection and tuberculous disease are contrasted. The modes of transmission are briefly stated as (1) droplet infection; (2) from bacilli in dust from dried sputum; (3) by direct infection; (4) by personal contact, and by the use of articles that have been used by infected persons. There is stressed the four-fold cost of the disease in lives, disability, happiness and money. Hospitals and sanatoria and their management are briefly considered, followed by a chapter on the after-care of consumptives. Perhaps the most important chapters of the book are those devoted to tuberculosis dispensaries and the public health nurse.

The other subjects are tuberculosis and its relation to schools, housing and occupations; also notes on an antituberculosis program for the small town and on the needs of the tuberculosis campaign in general.

The book is well written and should prove a valuable one, especially to nurses and those who have this problem to face.

Edgar Erskine Hume.

Tropical Ophthalmology, by Robert Henry Elliot, M.D., B.S. (Lond.), Sc.D. (Edin.), F.R.C.S. (Engl.); Lieutenant Colonel, I.M.S. (Retired); Late Superintendent of the Government Ophthalmic Hospital, Madras, and Professor of Ophthalmology, Medical College, Madras; Honorary Fellow and Gold Medallist of the American Academy of Ophthalmology and Otolaryngology; Lecturer in Ophthalmology, London School of Tropical Medicine; Ophthalmic Surgeon to the Seamen's Hospital Society, and to the Hospital for Tropical Diseases, Endsleigh Gardens, London. With 7 plates and 117 illustrations, 525 pp. London: Henry Frowde, Hodder & Stoughton; Oxford: University Press, 1920. 8°. Price, $9.60.

The author begins this work with a word to the physician expecting to practice in the tropics that there are certain fundamental conditions in tropical lands which are radically different from those at home and which he must learn to accept if he is to succeed in his work. The many influences at work are appreciated only after years of residence and experience. The factors of this kind considered in the introduction are: Railway facilities; the poverty of the people; the mental attitude of the people; the almost universal suspicion of foreign agencies; the influence of unqualified native practitioners (with their practice of couching for cataract, the introduction of irritant substances into the con-

junctival sac with a view to restoring consciousness, etc.); and finally the great prevalence of eye diseases.

Section II deals with the effects on the eyes of the strong light of tropical countries. The author considers the physical properties of bright light in general, glare asthenopia, glare conjunctivitis, injuries of the eyes by lightning, eclipse blindness, night blindness, and colored vision with the treatment of each of these conditions. Section III considers the effects of exposure of the eyes to wind and dust in tropical countries, in which there is embodied a discussion of the points for and against the widespread belief in this factor as the causative agent in the production of pinguecula and pterygium, and epidemics of ophthalmia.

In Section IV injuries inflicted on the eye by animals in the tropics are discussed. In introducing this subject the author invites attention to the superabundance of the lower animals in the tropics. The swarms of white ants, green bugs, "eye-flies," bees, mosquitoes, ticks, centipedes, etc., many of which are but lightly touched upon in the literature, due, he remarks, "to man's inclination to write but little of the occurrences of daily life." The injuries caused by flying insects are divided into three categories: First. mechanical injuries; for example, the "eye-fly" (*Siphonella funicula*) of the Deccan, which invades the house in thick black clouds in hot weather and to which the mosquito net offers no resistance. Second, chemical injuries due to the insect actually entering the conjunctival sac; for example, the green bug (of the family Jassidae); or irritation caused by parts shed from insects, for example, *ophthalmia nodosa* caused by caterpillar-hairs; or by vegetable matter carried into the sac by insects, for example the Cuban fly which lives upon a poisonous plant, the *Euphorbia ferox*, from which it carries the pollen to the lids of sleeping people, producing a severe vesicular eruption. The third category embraces septic infection due to insect agency. In the same section are considered injuries by stings and bites, including those of wasps, bees, mosquitoes, ants, ticks, leeches, etc.

Section V is devoted to the important subject of parasitic diseases of the eye. The trematodes (for example, *Paragonimus ringeri*), the cestodes (for example, *Sparganum mansoni*); the nematodes (for example, filaria and hookworms); arthropoda (for example, ocular myiasis), and the miscellaneous parasitic diseases, Rhinosporidium Kinealyi, Mycetoma, Aspergillosis, and Murmekiasmosis Amphilaphes.

Section VI is devoted to a complete discussion of the Indian operation of couching for cataract, including statistics, pathology of the conditions wrought by the native physician, etc. In Section VII cataract extraction is divided into chapters on the selection of cases for operation, the preparation of the patient for operation, asepsis, antisepsis and general arrangements; methods of operating for cataract; the Madras cataract operation (this chapter by Lieut. Colonel H. Kirkpatrick); warnings and rules; after-treatment and the frequency of cataract.

Section VIII deals with diseases of the conjunctiva, i.e., phlyctenular conjunctivitis, trachoma with its complications, the results of the various forms of chronic conjunctivitis, Parinaud's conjunctivitis, Samoan conjunctivitis, spring catarrh, filarial conjunctivitis. Part 2 of this section concerned with diseases of the cornea, including superficial punctate keratitis, filamentary keratitis, Herbert's corneal plaques, lead incrustation of the cornea and septic ulceration. In this section there are also two chapters on diseases of the lids.

Section IX embraces miscellaneous subjects. The anatomical peculiarities of dark skin races; glaucoma; neoplasms of the eyeball and adnexa; refraction; ophthalmoscopic appearances in the tropics (by Lieut. Colonel H. Kirkpatrick) and a chapter on hospital management.

Section X, which constitutes the remainder of the book, is devoted to certain general diseases especially from the standpoint of the ophthalmologist. The diseases considered

are beriberi, cholera, dysentery, leprosy, malaria, quinine poisoning, pellagra, plague, smallpox, trypanosomiasis, typhus, yaws (by Dr. Louis W. Sanbon), etc.

This work, attractive in form and arrangement, is one which no one interested in this subject should be without. The facts are set forth with precision and clearness, and the book is very interesting even for the general reader. The photographs, which are numerous, are excellent and well chosen. In addition to the subject matter above outlined, the book contains much sound advice and is a great addition to the literature on the disease of tropical countries.

EDGAR ERSKINE HUME.

VITAL STATISTICS, An Introduction to the Science of Demography, by George Chandler Whipple, Professor of Sanitary Engineering in Harvard University; member of Public Health Council, Massachusetts State Department of Public Health. Second edition. 12°, 579 pp. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Limited, 1923. Price, $4.00.

Professor Whipple's well-known and valuable book for students beginning the study of vital statistics appeared first in 1919 and was intended primarily for the use of Professor Whipple's class in vital statistics at the School of Public Health at Harvard University and the Massachusetts Institute of Technology. The book has become very widely known and very popular, as is shown by its general use in the United States and by the existence of translations in foreign languages, including Japanese. Professor Whipple answers the often-heard statement that anything can be proved by statistics by saying: "Suppose we substitute the meaning of statistics and say 'You can prove anything by facts if expressed in figures.' Obviously this is not so. Facts are facts, whether expressed in figures or not. If the conclusions are wrong, the trouble lies not in the statistics but in the way they are used. The drawing of conclusions is the function of logic, a process of reasoning and fallacious reasoning should not be charged against statistics."

In the second edition the tables have been corrected so as to include the data of the 1920 Census and the changes made in the International List of the Causes of Death made at the Paris Congress in October, 1920. This alone would make a second edition of the book desirable, for the International List has changed many of the numbers so that the use of the numbers as fixed in 1909 would lead to serious errors. For example, diseases of the skin and cellular tissue formerly bore the numbers 142–145, whereas in the 1920 list Nos. 143–150 deal with the puerperal state. Another valuable addition since the book first appeared is the list of occupations and occupation groups with their symbols.

The book having been prepared originally for use in Massachusetts includes a great many Massachusetts statistics, but this is no disadvantage for its use elsewhere. The book is a valuable one for medical men in general and for beginners in this study of vital statistics in particular. The sixteen chapters deal with demography, statistical arithmetic, statistical graphics, enumeration and registration, population, prediction of future population, general death rates, birth rates and marriage rates, specific death rates, causes of deaths, analysis of death rates, statistics of particular diseases, studies of death by age periods, probability, correlation, life tables, and a final chapter on miscellaneous subjects. The appendices give references, the

model state law for morbidity reports, the model state law for registration of births and deaths and a table of logarithms of numbers.

EDGAR ERSKINE HUME.

AIDS TO TROPICAL HYGIENE, by Col. R. J. Blackham, C.B., C.M.G., C.I.E., D.S.O., M.D., F.R.F.P.S., M.R.C.P.E., D.P.H. (Lond.), Chevalier of the Legion of Honour; Croix de guerre avec deux palmes et etoile; Knight of Grace, and medallist Order of St. John; Member of the Order of Mercy, Kaiser-I-Hind medallist for public service in India; of the Middle Temple and Gray's Inn, Barrister-at-law; late Deputy Director of Medical Services, Ninth Army Corps, B.E.F., in France. With a preface by Lieut. Gen. Sir John Goodwin, K.C.B., C.M.G., D.S.O., K.H.S., F.R.C.S., Director-General, Army Medical Service. Second edition, enlarged, thoroughly revised, and mostly rewritten. 16°, 240 pp. New York: William Wood & Co., 1922. Price, $1.75.

This little book is written primarily for those who expect to go to the Tropics as health officers and is based on the author's long experience in India and other British colonial possessions. The chapters deal with The Climate of the Tropics; Air and Ventilation; Water and Water-Supplies in the Tropics; Food and Feeding; Clothing in the Tropics; Sites, Soils and Houses; the Disposal of Refuse in the Tropics; Disposal of the Dead; Insects, Arachnids, and Rats; Animal Parasites; The Prevention of Malaria; and Disinfectants and Disinfection in the Tropics, to which are added appendices on meteorology and the distinctive characters of three flies found in houses. An epidemiological table of diseases of great value is included. In this there are given in tabulated form for each of the tropical communicable diseases the mode of infection, causal agent, vector or medium, reservoir, incubation period, and data regarding the isolation or segregation of patients, the quarantine of contacts, and general preventive measures.

The chapter on malaria is excellent in its discussion of mosquito prevention and control, and is equally valuable to the health officer who must deal with yellow fever and the other mosquito-borne diseases.

The chapter on animal parasites deals only with the protozoa, and it is thought that the addition of other animal parasites would have made it of much greater value. The book contains no discussion of hookworm and the fluke infections, and there is a noticeable absence of any discussion of methods of destroying rats.

The book is attractive in form and arrangement, and it is thought that any medical man or other person interested in public health who plans a stay in the Tropics or even a brief visit cannot secure this information in more concentrated and interesting form.

EDGAR ERSKINE HUME.

THE RIDDLE OF THE RHINE; CHEMICAL STRATEGY IN WAR AND PEACE, by Victor Lefebure, Officer of the Order of the British Empire, Chevalier of the Legion of Honor, etc., with a preface by Marshal Foch and introduction by Field Marshal Sir Henry Wilson, Bart., Chief of the Imperial General Staff. New York: E. P. Dutton & Co., 1923. Illustrated.

In this work of 275 pages Major Lefebure takes up for serious consideration the question of chemical warfare. not only as it existed during the World War but as to its possibilities in future wars.

Major Lefebure is in a position to speak *ex cathedra* on this subject, since he was on the firing line with the British at the time the Germans threw over their first gas cloud and continued in close touch with gas warfare in this capacity and as liaison officer with the French and other allies until the end of the war. Furthermore, he had post-armistice experience in Paris and the occupied territories, assisting Lord Moulton on various chemical questions and in surveying the great chemical munition factories on the Rhine. Further, his association with the dye industries and a visit to the United States have placed him *au courant* with the topic of which he writes.

The book really has two *motifs*: one, the history of the development of this type of warfare, both by the Germans and the Allies; and second, some speculation as to what may be anticipated in any future wars which may arise. He is quite frank in acknowledging, as are most practical and thinking men, that in future hostilities chemical warfare will most certainly have a place, and a very important one, since the experiences in Europe from 1915 to 1918 demonstrated that, whatever may be the moral stigma attaching to this class of combat, its effectiveness as a weapon is so certain that it cannot be neglected.

He points out very clearly the difficulty of any formal prohibition of the use of this arm under the limitation of armament, since there is such a close alliance between peacetime industries dealing in organic chemical products and the war-time manufacture of poison gas. He shows this very clearly in the development of the German *Interessen Gemeinschaft* which, prior to the World War, was engaged in the manufacture of dyes and synthetic drugs, and which in an unbelievably short time was converted to the production, on a large scale, by the simplest procedure, of the various chemicals used in war. He shows very conclusively that there is such an interlocking between the two phases that it would be [is] practically impossible to inhibit one and not the other. In this connection Major Lefebure says, on page 120:

> There can be no doubt, therefore, that the mere contact of two armies during war acts as a check against the decisive use of chemical warfare, except in the very early stages. During peace this contact will be practically non-existent, and it would be possible for any country so to diverge in its lines of research and discovery that, given rapid means of production, it could repeat the German surprise of 1915, this time with decisive results. Should such a nation possess a monopoly in the means of rapid production, the world is practically at her mercy. Should she be prepared to break her word, the usual means of controlling disarmament are impotent against these developments.

Again, on page 145:

> Any eventual chemical surprise will, under genuine conditions of disarmament, depend on peace industry, for no such conditions will tolerate the existence of huge military arsenals. We have already indicated the type of peace-time industry *par excellence*, which can rapidly and silently mobilize for war. It is the organic chemical industry. Therefore, whatever the war may have taught us as to the value of chemical industry, its importance from the point of view of a future war is magnified many times. The surprise factor is responsible. The next war will only commence once, however long it may drag on, and it is to the start that all efforts of a nation planning war will be directed. It is, therefore, of importance to examine in detail the development of chemical production during the recent war.

The inference to be drawn from Major Lefebure's writings here quoted is obvious.

On page 149 he says:

> The unusual speed with which a standard dye-producing plant was converted for the production of explosives is instanced in the operation of a TNT. plant at Leverkusen, producing 250 tons per month. The conversion only took six weeks. The factories of the Interessen Gemeinschaft supplied a considerable proportion of the high explosives used by Germany.

This is a very plain statement on the question of preparedness; not the preparedness

which has no other end than the development of war, but one which has a definite materialistic status as to question of trade and traffic in peaceful times, but which is none the less available as a means of defense in time of threatened danger.

Throughout his writing Major Lefebure weaves together the history of this means of warfare with speculation and warning as to what may occur in the event of future conflict. This warning is against the existence of a monopoly of those trades which are dependent on organic chemistry in any one country. Germany has long been supreme in this field of industry, and this supremacy enabled her to do with ease what was later accomplished only by herculean effort by the Allies—the manufacture, in non-negligible quantities, of lethal gases. He holds—and rightly, we believe—that there is no logical reason for the existence of this German monopoly in the field of organic chemistry. The late war made it incumbent on the Allies to produce for themselves the dyes and chemicals for which they had been dependent on Teutonic output. There would seem to be no reason for this dependence. Granted German scientific achievement along these lines, that does not by any means predicate that an equivalent and equally effective organization could not be launched and established by scientists of other nationalities. Especially so since this very thing was done as a war necessity between 1915 and 1918.

On the final page of his work Major Lefebure says this of the United States:

> One alone of the Allied and Associated Powers was able to see the chemical menace with clear and unprejudiced vision. This was America, for she not only entered the war less hampered by traditions than the rest, but at a period when the chemical war was in full blast. More than a quarter of all her casualties were due to "gas," and no other arm produced as many in her ranks. As a result we see America establishing an independent peace Chemical Warfare Service, as sister service to the infantry and artillery. This can only be interpreted as a frank realization of the place of chemical warfare and of the need for serious international guarantees in the present situation.

It is of some interest to know that, of all the signatories of the Hague covenant, the United States was the only one which never subscribed to the article forbidding the use of asphyxiating gas in warfare. Great Britain held out with her for one year, but at the subsequent conference joined the majority for prohibition.

The book is made up of twelve chapters and a conclusion. The headings are as follows: I. Explanatory; II. The German Surprise; III. The Allied Reaction; IV. Intensive Chemical Warfare; V. Chemical Warfare Organizations; VI. The Struggle for the Initiative; VII. Review of Production; VIII. American Developments; IX. German Chemical Policy; X. Lines of Future Development; XI. Humane or Inhumane? XII. Chemical Warfare and Disarmament; Conclusion: The Treaty of the Future. There are five full page illustrations.

James Robb Church.

Public Health Surveys: What they are. How to make them. How to use them. By Murray P. Horwood, M.S., Ph.D., Instructor, Department of Biology and Public Health, Massachusetts Institute of Technology. New York: John Wiley and Sons, Inc., 1921.

This little book as its title indicates is intended to serve as a guide in the making of public health or "Sanitary" surveys.

There is a foreword by the late Prof. William T. Sedgwick which was written a very short time prior to his death. The author in a footnote states that it is probably the last thing he wrote for publication.

Following this there is a ten-page introduction by Prof. George C. Whipple of the Harvard Engineering School.

The subject matter itself covers 369 pages divided into the following chapters:

I. General Information about Public Health Surveys.
II. Organizing a Community for a Public Health Survey.
III. Methods Employed in Making a Public Health Survey.
IV. General Information about the Community.
V. Water Supply.
VI. Drainage, Sewerage and Sewerage Disposal.
VII. Collection and Disposal of Refuse.
VIII. Milk Supply.
IX. Inspection of Restaurants, Lunch Rooms and Food Stores.
X. Housing.
XI. School Sanitation.
XII. School Hygiene.
XIII. Organization and Activities of the Health Department.
XIV. Hospital Facilities.
XV. Tuberculosis.
XVI. Vital Statistics.
XVII. Analysis of City Budget.
XVIII. The Preparation of the Report.
XIX. Recommendations from other Survey Reports.
XX. Methods of Obtaining Results from the Public Health Survey.
XXI. The Value of the Public Health Survey in the Public Health Campaign.

The scope of the work can be judged to a certain extent by a perusal of this list of chapter headings.

Each chapter describes at first a more or less ideal condition of the matter under consideration. This is followed by groups of questions concerning various phases of the subject which will aid the surveyor in bringing out the important points. The answers to these questions will constitute, as a rule, a complete description of the subject.

For instance, in the chapter on Sewage Disposal, under the heading Trickling Filtration the following questions are proposed:

When was the first trickling filter put into operation? Of what material is it made? How many filters are in use? What is the area of each? What is the depth of each filter? What is the filtering medium? What are the minimum and maximum sizes of the filtering medium? Where is the final effluent discharged?

How is the sewage applied to the filter? How much sewage is applied at each dose? What method is employed to distribute the sewage uniformly over the bed? If a nozzle is in use, what is the type employed? What is the maximum head maintained on each nozzle? Is the equal distribution on the filter produced by a falling head?

What are the dimensions of each dosing tank? How is the dosing chamber filled? What is the period required for a dose to be completely discharged? What is the rest period between doses? What is the rate of treatment per acre per day? Does the sewage reach the dosing chamber by gravity, or is it pumped? If the latter, how high is it elevated? Has the filter shown any signs of clogging? If so, what measures are taken to overcome it? Is the bed open or covered? What precautions are taken to prevent freezing? Is the normal ventilation which takes place during filtration supplemented in any way? If the effluent is treated by secondary sedimentation, ascertain the method employed, and answer the questions recorded for that process.

Is the operation of the bed supervised and controlled by laboratory tests? If so, how often are these tests made, and by whom? Obtain and record any data regarding the operation of the filter bed and the quality of the effluent.

Sanitary surveys are valuable measures used by the public health official to prevent disease. This book will be found to be of great aid to the individual who is undertaking this work.

The army medical officer will find it of assistance in the investigation of conditions in extra camp or cantonment areas and in time of war in studies of communities in occupied territory.

George F. Lull,
Major, Medical Corps.

THE MARNE MIRACLE, by Col. William K. Naylor, U. S. Army. Washington: The U. S. Infantry Association. Cloth, 12 mo, 190 pages. Price, $1.50.

Col. William K. Naylor, the author of "The Marne Miracle," is now Assistant Chief of Staff G-2 (Military Information), of the United States Army. He is recognized as the foremost military strategist and student of military history and its application to the principles of war, in the country.

During the war Colonel Naylor served as Chief of Staff of a Division (33d National Guard Division from Illinois) and Chief of Staff of the 9th Army Corps. Since the war he has served as an instructor at the General Service Schools at Fort Leavenworth, Kansas, where he made a most enviable record in the Military Art Department in connection with the conduct of his course of Military Strategy and his wonderful lectures on Military History. Following his tour of duty at Fort Leavenworth he went to the Army War College at Washington as an instructor, where he served until his present detail took him to a high place in the War Department as one of the five assistants to General Pershing.

Here are some of the points that are discussed in the book and the answers supplied:

1. Why do the French call the Battle of the Marne a miracle? Why do the Germans refer to it as a tragedy?

2. Was Germany, in all her boasted military efficiency, prepared for the World War? Wherein was she unprepared?

3. What was the German plan of campaign? Was it that proposed by Von Schlieffen? Was it Von Moltke's? Was it a combination of the two?

4. What were France's plans for the war with Germany? Were they offensive or defensive at the outset?

5. Did the stand made by the Belgians at Liege save France?

6. Did Germany rush over defenseless Belgium in overwhelming numbers? Who were the stronger, the Germans or the Allies at this time?

7. What prevented the Battles of Mons and Charleroi from being complete German triumphs?

8. Were the British wiped out at Le Cateau? Did they stop Von Kluck?

9. Was Von Kluck responsible for the loss of the Battle of the Marne?

10. Why did the Germans fall back? Who is responsible for the order to retreat? Was it Foch's attack at Fere Champenoise?

11. Who was Von Hentsch? What part did he play in the orders for the German retreat?

12. Why did Germany lose?

All of these questions are discussed in a most interesting manner and the conclusions and answers supplied.

MERCK'S MANUAL OF THE MATERIA MEDICA. Fifth Edition. New York: Merck & Co. Flexible linen cloth, 50 cents; Artificial leather, $1.00.

A convenient, up-to-date, ready reference pocket book on the Materia Medica intended mainly for physicians' use. Previous editions are so well known that perhaps no extended review of its contents is necessary. The book is of wide scope and on broad lines. In addition to a thorough revision of the text, much of which has been rewritten, important new matter has been added to this edition, which contains 581 pages.

APPLIED PHARMACOLOGY, by A. J. Clark, M.C., B.A., M.D., F.R.C.P., Professor of Pharmacology in the University of London; Examiner in the Universities of London, Edinburgh and Wales; Formerly professor of pharmacology in the University of Cape Town. With 46 illustrations, 8°, 390 pp. Philadelphia: P. Blakiston's Son & Co., 1923.

This book comprises an account of the scientific evidence directly available in determining what is really the therapeutic action of the most important drugs. It stresses the

importance of this knowledge in the clinical application of drugs. The author insists upon the close relationship between pharmacology and therapeutics, and urges that these two subjects be taught to the medical student in such manner as to impress upon him the necessity for the coordination of these two branches of his art in every day practice.

The arrangement of the book is such as to group together, very logically, those drugs which have similar therapeutic applicability. The individual subjects with which it deals are indicated by the following table of contents:

There are many tables and graphic reproductions which serve to illustrate and clarify the printed text. Each chapter is succeeded by an apparently very complete and well arranged bibliography.

A. N. Tasker.

Essentials of Surgery, a Textbook of Surgery for Student and Graduate Nurses and for Those Interested in the Care of the Sick: By Archibald Leete McDonald, M.D., The Johns Hopkins University. Formerly in charge of Department of Anatomy, University of North Dakota; Lecturer on Surgery, Nurses' Training School, St. Luke's Hospital, Duluth, Minnesota; Member Western Surgical Association. 49 illustrations, 2nd Edition revised. 8°, 293 pp. Philadelphia and London: J. B. Lippincott Company, 1923.

The Lippincott's series of Nursing Manuals includes many valuable volumes on the broad specialties of medicine and surgery intended for use in nurses' training schools. These books are so written as to give in the simplest phraseology a broad general view of the subject together with such directions and formulae as will be found most useful by the registered nurse in her labors which are complementary to those of the physician and surgeon. Dr. McDonald's "Essentials of Surgery" for nurses is one of these works. The individual subjects with which it concerns itself are as follows: "Bacteria," "Common Types of Local Infection, Portals of Entry," "Effects of Specific Pathogenic Bacteria," "Tumors or New-Growths," "Wounds, Hemorrhage, Surgical Operations and Anaesthesia," "Bones and Articulations," "Vascular, Lymphatic and Nervous Systems," "The Head,

Cranium and Face," "The Neck, Cervical Region," "Thoracic Cavity and Breast," "The Abdominal Cavity, Walls and Peritoneum," "The Gastro-intestinal Organs, Stomach, Small and Large Intestine, Rectum, Anus, and Vermiform Appendix," "The Liver, Bile-passages, Pancreas, and Spleen," "The Urinary Organs, Kidney, Ureter, Bladder, and Urethra," "Surgical Lesions of the Uterus, Fallopian Tubes and Ovaries," and "Glossary."

While it is true that this series is intended essentially for nurses, nevertheless its individual members will be by no means useless to the practising specialist,—particularly on occasions when he desires to find in condensed form a brief discussion of certain subjects outside his own specialty.

A. N. Tasker.

Physics and Chemistry for Nurses, by A. R. Bliss, Jr., A.M., Phm.D., M.D., Lecturer on Chemistry and Materia Medica, Grady Hospital Training School for Nurses, Atlanta; Professor of Pharmacology, Emory University, School of Medicine; Passed Assistant Surgeon, U. S. Public Health Service Reserve; Formerly Professor of Chemistry and Pharmacology, Graduate School of Medicine, University of Alabama, and A. H. Olive, A.M., P.Ch., Phm.D., Lecturer on Chemistry, Hillman Hospital Training School for Nurses, Birmingham; Associate Roentgenologist, Hillman Hospital; Superintendent of University Free Dispensary, U. S. Public Health Service (State, County, and City); formerly Professor of Physics and Chemistry, Howard College; Associate Professor of Chemistry, Graduate School of Medicine, University of Alabama. 70 Illustrations. Third Edition thoroughly revised and rewritten and conforming to the requirements of the standard curriculum (1922) of the National League of Nursing Education. Collaborators: Francis W. Witte, R.N., Principal, Training School, N. Y. State Hospital, New York City, N. Y.; Ethel Johns, R.N., Asst. Professor, Dept. of Nursing, Univ. of British Columbia, Canada; Sr. Mary Alma, Ph.G., R.N., Lecturer on Chemistry, Training School, Mercy Hospital, Canton, Ohio; Alice L. Lake, B.S., R.N., Educational Director, Training School, Univ. of Mich., Ann Arbor, Mich.; Stella Ackley, R.N., Educational Director, Training School, Milwaukee County Hospital, Wautosa, Wis.; Adelaide M. Leffingwell, R.N., Instructress of Sciences, Training School, Lakeside Hospital, Cleveland, Ohio. 8°, 190 pp. Philadelphia and London: J. B. Lippincott Company, 1923.

A well-arranged and clearly expressed manual of physics and chemistry for those who are to receive their first instruction in these subjects as a side issue to other professional studies. The definitions of "Science," "Matter," "Biology," "Chemistry," "Substances," "Bodies," "Mass," "Molecules," "Atoms," "Elements," "Compounds," "Extension," "Division," "Impenetrability," "Porosity," "Compressibility," "Inertia," "Elasticity," "Indestructibility," "Density," "Specific Gravity," etc., etc., are so clear and concise as to render them capable of conveying easily the fundamental idea stripped of unnecessary verbiage. Worthy of especial mention is the Appendix which includes very useful as well as simple formulae and directions arranged under the following headings:

Urinalysis.
Removal of stains.
Cleansing Agents for Metals, etc.
Stains on Human Skin.
Fuels.
Weights and Measures.
Glossary.
Percentage Solution Table.
Melting Point Table.
Specific Heat Table.

Food Chart.
Table of Elements and Atomic Weights.
Materials for Chemistry Experiments.
Index of Chemistry Experiments.
Chemistry Index.

The little book is of a class with and maintains the high standard of excellence of the other volumes which have appeared in "Lippincott's Nursing Manuals."

A. N. TASKER.

ADDRESSES AND PAPERS, DEDICATION CEREMONIES AND MEDICAL CONFERENCE, Peking Union Medical College, September 15–22, 1921. Peking, China, 1922. Rumford Press, Concord, New Hampshire, 416 pp.

The assistance given by the Rockefeller Foundation to Medical Education throughout the world is well known. One of its most noteworthy activities in this field was brought to a sort of climax of formality in the dedication ceremonies and medical conference at the Peking Union Medical College in the week of September 15–22, 1921. Upon this occasion there were present many members of the medical profession and laymen whose names are widely known. Mr. John D. Rockefeller, Jr., represented the Rockefeller Foundation. Gen. Leonard Wood, Governor General of the Philippine Islands, Dr. William H. Welch of the Johns Hopkins University, Dr. George E. de Schweinitz, president of the American Medical Association, Dr. Victor J. Heiser of the International Health Board, Dr. A. B. Macallum of McGill University, and Dr. Theodore Tuffier of the University of Paris and French Academy of Sciences, were some of the more notable among the distinguished group of philanthropists and educators who went to Peking for the dedicatory exercises.

The commemorative volume gives an account not only of the actual ceremonies and the addresses attendant thereon, but includes also a very considerable number of medical papers (and accounts of clinics) presented to the assemblage.

A. N. TASKER.

NURSING AND NURSING EDUCATION IN THE UNITED STATES. Report of the Committee for the Study of Nursing Education and Report of a Survey by Josephine Goldmark, Secretary. New York: Macmillan Company, 1923.

In December, 1918, at the invitation of the Rockefeller Foundation a conference of persons interested in the development of Public Health Nursing was called in New York. Physicians, representatives of public health agencies and public health nursing organizations, leaders in nursing education, hospital administrators and other persons prominent in public health work attended this conference. The primary object of the meeting was a discussion of the status of public health nursing in the United States and of the education desirable for the training of the needed personnel. The outcome of the meeting was the appointment of a permanent committee to study the situation and to prepare a definite program for a course of training for public health nurses.

Josephine Goldmark, eminent student of social problems and industrial hygiene, was appointed secretary of the committee. Under her able jurisdiction was directed the survey and the compilation of reports concerning nursing and schools of nursing. After three years of intensive investigation Miss Goldmark has presented a wealth of material suitable alike for the general reader and for the directors and students of nursing education.

Submitted in this volume is the introductory note, the preliminary report of the entire committee (made public approximately a year ago) and the report of the secretary. The basic foundation is in the comprehensive report of the secretary thus organized.

Part A.—Functions of the Nurse:
I. Public Health Nursing.

II. The Nurse in Private Duty.
III. The Nurse in Institutions.
Part B.—Training of the Nurse:
IV. The hospital School of Nursing.
V. Training Courses for the Subsidiary Nursing Group.
VI. The University School of Nursing.
VII. Postgraduate Courses.
Appendix-Schedules Used in Survey.

This is an exhaustive treatise on nursing and nursing education as obtained from a detailed study of 23 selected schools of nursing maintained by hospitals of diverse size, both general and private, located in various regions of the United States. The center and focus of the survey is in the dual character of the school of nursing itself in functioning within the hospital both as an educational institution and as a provider of nursing service. The problem is to establish a type of basic training uniting theory with hospital clinical facilities that shall make the nurse the most efficient common field agent of national health movements. The solution is in the realization of the necessity of support for the hospital in order that it may be made independent of the training school for its permanent nursing staff. A multitude of related problems press to the foreground in the treatment of the main issues. It is indeed difficult to realize in all its varied aspects the full significance of this report. The extent of the achievement is deserving of more comment than is possible within the limits of a brief review.

The subject throughout is originally treated. The presentation is in observation, not theory. Just impartiality brings knowledge, carefully condensed, documented and abundantly verified with significant grafts, tables and schedules, convincingly not only to those who are in need of it but to the entire public. In this inclusive study the problems presented and somewhat the nature of their solutions are essentially in keeping with previous findings by nurse educators who have sincerely desired something finer and better for all students in schools of nursing and a more efficient service rendered humanity than experience has yet offered.

It is of tremendous importance that in the determination of policies during the present transitional period of educational institutions of nursing that there is now embodied in written form so unbiased an interpretation of contemporary conditions. The keen experienced eye of the investigator has revealed to us a cross section of what is at once the oldest art and the newest profession. It is, as it were, an X-Ray picture of a field of service submitted to the clinical diagnosis of intellectual surgery.

In the new criterions of service the potentialities and purposes of nursing can no longer be properly relegated to the juvenile adolescent stage of apprenticeship development but must rank mature as correlative functional principles of community responsibility. Under the inspiring touch of a master hand the past and the future come together. Confused standards consequent to age-old traditions yield to the possibilities of the renaissance even now at hand.

Elizabeth Melby,
Chief Nurse, A. N. C.

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